Subclinical Delusional Ideation and Reasoning

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To Alan.

Abstract

Delusions are fixed beliefs that are not amenable to change in light of conflicting evidence (APA, 2013) and are a symptom most often associated with schizophrenia. Evidence suggests that psychotic symptoms, such as delusions, exist on a continuum from the healthy population to clinical disorder (van Os, Linscott, Myin-Germeys, Delespaul & Krabbendam, 2009; van Os & Reininghaus, 2016). Research demonstrating that biases in reasoning contribute to the formation of such delusional beliefs has gathered momentum and has been shown in both clinical and healthy, non-clinical populations (e.g. Warman, Lysaker, Martin, Davis, & Haudenschield, 2007). Liberal acceptance has only been demonstrated previously in patients with schizophrenia therefore the current thesis aimed to examine whether a liberal acceptance reasoning style would be evident in a subclinical sample consistent with a continuum model and to examine factors that may underpin this acceptance.

In Chapters 3-5 and Chapter 8, it was found that there was a tendency for those high in delusional ideation to rate stimuli with both delusional and neutral content as more likely to be true compared to those low in delusional ideation indicating a lowered threshold for plausibility, consistent with a liberal reasoning style. It was a fairly consistent finding that stimuli with delusional themes were rated as more exciting than stimuli with neutral themes by participants high in delusional ideation, highlighting a potential mechanism for why narratives with delusional and neutral

content are more likely to be accepted (Chapter 2, 5 & 8). Sensation seeking however did not provide an explanation for finding excitement in delusional stimuli and creativity was only implicated when this was in regards to emotional creativity in Chapter 3. Furthermore, perceptual and non-perceptual apophenia (the tendency to see patterns where none exist or make causal connections between random events) appears to play a central role in why participants high in delusional ideation liberally accept. Embedded objects were reported in visual 'noise' where no object had been embedded by participants high in delusional ideation in Chapter 4. Consistent with this, participants high in delusional ideation also tended to report experiencing more coincidences than those low in delusional ideation in Chapters 5 and 8. This is important for the liberal acceptance account since the ability to see patterns where none exist and make causal connections between random events may be a factor in why delusion-prone individuals see plausibility where others do not.

Liberal acceptance was also investigated in light of findings from studies with clinical patients in Chapters 6 and 7. In Chapter 6, participants assigned plausibility ratings to interpretations of ambiguous pictures to see if those high in delusional ideation see plausibility in interpretations that others would reject or rate lowly. Similar trends were found in a subclinical sample, to that found in Moritz and Woodward's (2004) original study and participants high in delusional ideation rated more of the interpretations as possible, good or excellent compared to participants low in delusional ideation, who rated more of the interpretations as poor; these effects however did not achieve significance. When probability estimates and decision and rejection thresholds were examined using the 'Who Wants to be a Millionaire?'

paradigm (see Moritz, Woodward & Hausmann, 2006), differences between participants high and low in delusional ideation did not emerge in Chapter 7.

The series of experiments reported in this thesis have been successful in highlighting under what conditions participants high in delusional ideation liberally accept and in identifying potential factors that underpin this acceptance. Limitations of this research, theoretical implications and directions for future research are considered in the General Discussion in Chapter 8.

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Chapter I

Introduction

Definition of delusions

Delusions are present in a number of psychiatric diagnoses but are most often thought of as a symptom of schizophrenia (Mujica-Parodi, Greenberg, Bilder, & Malaspina, 2001; Tandon & Maj, 2008), with schizophrenia affecting around 1% of the population (Johns & van Os, 2001). Eighty percent of those with schizophrenia will suffer persecutory delusions (Freeman, 2007) and between 20-50% will report grandiose delusions (Knowles, McCarthy-Jones & Rowse, 2011).

The concept of delusions has a long history (Berrios, 1991), however the attempts most recently to define delusions have mainly concentrated on the ideas first introduced by Karl Jaspers (1913). Jaspers defined three main areas concerned with psychiatric patients' beliefs; these included the conviction with which the belief is held, the tendency for the belief/s to be unreceptive to evidence or counterarguments and often the tendency to have bizarre content. However, Jaspers also made the distinction that for a belief to be delusional rather than a delusion-like idea, it must also be non-understandable. As some have noted, (Bentall, Corcoran, Howard, Blackwood, & Kinderman, 2001) it is difficult to operationalize the criteria of non-understandability and thus definitions of delusions have mainly concentrated on these three criteria highlighted by Jaspers (1913). Until most recently delusions have been defined as:

> *A false belief based on incorrect inference about external reality that is firmly sustained despite what almost everyone else believes and despite what constitutes incontrovertible and obvious proof or evidence to the contrary. The belief is not one ordinarily accepted by other members of the person's culture or subculture (e.g. it is not an article of religious faith)* (DSM-IV, 2000; p. 765.).

However, this definition has received criticism. For example, non-bizarre delusions could essentially occur in real-life situations such as believing you are being followed, poisoned or deceived by someone (Bell, Halligan & Ellis, 2003). In other words, the belief does not necessarily have to be false and it is left to clinicians to make a judgement about whether this is indeed, a false belief.

Researchers have also questioned the 'falsity' criterion (Spitzer, 1990) and additionally what constitutes 'incontrovertible falsity'- it is left unclear what level of evidence would be required for a belief to be 'incontrovertibly false' (Bell et al., 2003).

Furthermore, delusions need not be about 'external reality'. Indeed, delusions of control or passivity delusions usually refer to a person's own mental state such as experiencing one's thoughts and actions as not being their own. Some researchers have also questioned whether the delusional belief is firmly sustained. A study conducted by Myin-Germeys, Nicolson and Delespaul, (2001) found that patients' conviction of the truthfulness of a belief can vary over short periods of time, even over the course of a day, while Garety et al. (2005) found that approximately half of patients with delusions will accept the possibility that they may be mistaken about their beliefs. This suggests that delusional beliefs are not always firmly sustained.

With the publication of the fifth Diagnostic and Statistical Manual of Mental Disorders (DSM; APA, 2013), the definition of delusions has undergone some revisions. The new DSM has aimed to address some of the issues associated with defining delusions. According to DSM V, (Schizophrenia Spectrum and Other Psychotic Disorders; 2013);

> *Delusions are fixed beliefs that are not amenable to change in light of conflicting evidence. Their content may include a variety of themes (e.g. persecutory, referential, somatic, religious, grandiose). […]The distinction between a delusion and a strongly held idea is sometimes difficult to make and depends in part on the degree of conviction with which the belief is held despite clear or reasonable contradictory evidence regarding its veracity* (APA, 2013; p. 87).

The changes have implications for the current understanding of delusions. For example, what is most noticeable is the change of a *false* belief now being a *fixed* belief. In addition, delusions no longer need to be based on 'incorrect inference' about 'external reality' but can be about one's self or one's life experiences, for example. It must also be considered that proof is not always available that the belief is false and therefore, 'despite what constitutes incontrovertible and obvious proof or evidence to the contrary' has now been changed to 'despite clear or reasonable contradictory evidence regarding its veracity' in the new definition, reflecting more flexibility regarding the truthfulness of a belief than was afforded by the old definition.

Classification

Despite problems operationalising the definition of delusions, the concept of delusions as a central symptom of psychosis is widely accepted (Bell, Halligan & Ellis, 2006). Any theme can be present in a delusional belief, though some delusional beliefs appear to be more common than others. Table 1.1 presents some common themes in delusional beliefs.

Table 1.1

Common delusional themes and examples. Adapted from Bell et al. (2006).

Theme	**Example**
Persecutory	"I am being followed by the police"
Grandiose	"I am special, 'chosen'"
Bizarre	"People can read my mind and insert thoughts"
Somatic	"I am infested by parasites"
Cotard	"I am dead/ decaying"
Capgras	"My wife has been replaced by an impostor"
Reference	"The lyrics of that song are especially meant for me"

Delusions: Dichotomous or Continuous? Measuring subclinical delusional ideation

Despite psychosis generally being defined dichotomously for clinical purposes (van Os, Hanssen, Bijl, & Ravelli, 2000) a growing body of evidence suggests that psychosis exists on a continuum (Claridge, 1988; Freeman, Pugh, Vorontsova, Antley & Slater, 2010; van Os, et al, 2009; van Os & Reininghaus, 2016) and that those in the general population experience delusional ideation more often than previously thought. By this reasoning, there are people in the general population whose experiences, cognitions and behaviours are comparable to patients with schizophrenia, yet would not warrant a clinical diagnosis of psychosis. Some authors have noted that general population samples who engage in delusional thinking may be distinguished from clinical populations on their level of distress and preoccupation with a belief (Peters, Joseph & Garety, 1999).

The idea of dimensionality between normality and psychosis is by no means a new one (Bleuler, 1911; Rado, 1953; Meehl, 1962). Personality and individual differences were thought to be implicated in psychosis proneness some decades ago. This is emphasised in the schizophrenia literature, the idea of continuity in the disorder and that certain features of schizophrenia could be observed without the associated clinical signs of illness (Claridge, 1994).

Lawrie (2016) however raises issues surrounding the use of a continuum approach in clinical practice and argues that the current system does reasonably well without the need to differentiate between categorical and continuous approaches. Esterberg and Compton (2009) make a comparison between categorical and dimensional approaches to psychosis and conclude that while a categorical approach leads to greater reliability, a dimensional approach enhances validity. Although Lawrie (2016) supports the view that adding continuous scores that are related to symptom severity to categorical diagnoses could enhance aspects of clinical practice, more evidence would be required before a revolutionary change in clinical practice is justified. This evidence is being accrued and provides a strong justification for using this approach. Van Os and Reininghaus (2016) have suggested an 'extended psychosis phenotype' that is continuous with clinical psychotic disorder and shares features such as demographic, environmental, familial and psychopathological features with clinical psychotic disorder. Positive psychotic symptoms such as hallucinations and delusions can occur independently of disorder as in the subclinical population or can persist over time and eventually result in psychotic disorder (Van Os & Reininghaus, 2016). Consistent with this, earlier findings of Linscott and van Os (2013) demonstrated that the probability of persistent psychotic experiences is strongly correlated with baseline measures of psychotic experience. Of those exhibiting psychotic experiences at baseline, 7.4% went on to develop a psychotic disorder. This provides support for the continuum model of psychosis and this is important since, if the argument for a continuum is to be supported, research must demonstrate that there are changes over short and long periods of time between subclinical and clinical cases (van Os et al., 2009).

That psychosis exists on a continuum has been supported by studies such as that conducted by Chapman, Chapman, Kwapil, Eckblad and Zinser (1994), Poulton, Caspi, Moffitt, Cannon, Murray & Harrington (2000) and Hanssen, Bak, Bijl, Vollebergh & van Os (2005) who followed participants reporting psychotic experiences over longitudinal periods and then examined incidences of psychotic disorder. For instance, Chapman et al. (1994) identified participants who were psychosis prone (*n* = 534) and then re-interviewed the same participants after a 10-15 year period (*n* = 508). They found that particularly high scores on the Magical Ideation Scale and Perceptual Aberration Scale (or both) were strong indicators of psychosis proneness but that psychotic-like experiences at initial interview were also predictive of later psychosis proneness. Poulton et al. (2000) examined children at

11 years old and followed the same participants up to when they were 26 years old to determine if there was continuity in psychotic symptoms from childhood to adulthood. They found that as symptoms increased in the 11 year olds, so did the positive and negative symptoms of schizophrenia in 26 year olds. The group members with strong symptoms at age 11 were significantly more likely than the weak or control group to have an adult diagnosis of schizophreniform. Children with weak symptoms were also at risk of deleterious outcomes as an adult. Poulton et al. (2000) however acknowledges that this does not necessarily mean that a prodromal phase of schizophrenia can be spotted earlier but rather that covert behaviours (such as concealed unusual beliefs and experiences) may precede the more overt prodromal signs.

Hansenn et al. (2005) conducted a large scale study (*n* = 7076) examining the stability of subclinical psychotic experiences over a two year period. The incidence of psychotic experiences was also examined. They found that the most likely outcome of these experiences is that they cease to continue – only 8% of people who had a subclinical psychotic experience the first time they were examined had a subclinical outcome and a further 8% showed evidence of a clinical outcome. The number of reported psychotic experiences at time one and the emotional context had a strong influence on clinical outcomes but not on subclinical outcomes. The incidence of subclinical psychotic experience was also found to be much higher (100 times greater) than estimated incidences of psychotic disorders such as schizophrenia. These studies suggest some predictive value of whether psychotic experiences will eventually lead to psychotic disorder and while some will result in psychotic disorder, most will remain in the subclinical range.

In light of the above literature and support for the existence of a psychosis continuum it has subsequently been proposed that it would be more beneficial to study individuals in this subclinical category of psychosis proneness (e.g. DeRosse & Karlsgodt, 2015; Linney, Peters & Ayton, 1998; Mark & Toulopoulou, 2016). As some have noted, this avoids methodological difficulties such as medication effects, motivational issues, variation over time of severity of symptoms and general cognitive decline as a consequence of mental illness (Claridge, 1988). Thus, research on subclinical delusions allows researchers to make inferences regarding the clinical population (DeRosse & Karlsgodt, 2015; van Os & Linscott, 2012).

In psychology, research into subclinical symptoms has led to the development of a number of questionnaires that aim to measure liability to psychosis. These range from the Magical Ideation Scale (Eckblad & Chapman, 1983) measuring unusual experiences, the Schizotypal Personality Scale (Jackson & Claridge, 1991) modelled on DSM-III criteria for schizotypal and borderline personality disorders and the Psychoticism Scale (Eysenck & Eysenck, 1975; 1976) measuring personality traits, through to the more recent Oxford-Liverpool Inventory of Feelings and Experiences (O-LIFE; Mason, Claridge & Jackson, 1995; Mason, Linney & Claridge, 2005) measuring 'Unusual Experiences', 'Cognitive Disorganisation', 'Introvertive Anhedonia' and 'Impulsive Nonconformity'.

From these and other measures that have been developed, it can be argued that there has been a limitation on the number of questionnaires available that exclusively measure delusional thinking, especially in non-clinical populations (Peters, et al., 1999). One such scale, the Foulds Delusions-Symptoms-State Inventory (Foulds & Bedford 1975), was designed to measure four main types of delusion (delusions of grandeur, disintegration, persecution, and contrition); however, this was designed for clinical use and would be considered inappropriate for use in non-clinical populations since the items contain florid symptoms and would be unlikely to be consistent with delusional ideation in non-clinical populations (Peters et al., 1999). Thus, the Peters et al. Delusions Inventory (PDI; Peters, Day & Garety, 1996) was constructed to specifically measure delusional ideation in general population samples. This measure emphasises the importance of the distress associated with a belief, how preoccupied a person is by a belief and the conviction with which the belief is held. In doing this, it also emphasises the importance of continuity in delusional thinking and the potential for this to develop into psychotic illness, given that these factors of distress, preoccupation and conviction can interact and fluctuate over time, consistent with a continuum approach (Peters et al., 1999). For example, a person may believe with absolute conviction that things in magazines or on TV are written especially for them but they may not be particularly distressed or preoccupied with this. Conversely, they may be particularly preoccupied with the idea that people might communicate telepathically but not be distressed about it or really believe that it is true. Therefore, delusions can no longer be defined as ‘all or nothing’ phenomena, but as beliefs that lie on a continuum with normality.

Another similar measure that has been developed is the 42-item Community Assessment of Psychic Experiences (CAPE; Stefanis et al., 2002). This is based on three dimensions of positive, negative and depressive symptoms and measures frequency and distress associated with lifetime psychotic-like feelings, experiences and thoughts. The CAPE has been used in clinical settings to detect first episode psychosis successfully (Boonstra, Wunderink, Sytema & Wiersma, 2009; Mossaheb et al., 2012) and more recently, the 15 item CAPE (CAPE-P15) measuring positive symptoms such as grandiosity, paranoia and bizarre experiences has shown to be a valid and reliable measure of current psychotic like experiences in a non-clinical sample (Capri, Kavanagh, Hides & Scott, 2015).

Theories of Delusion Formation

Anomalous perceptual experiences, two-factor theories and the prediction error theory of delusions

Maher (1974; 2005) argued that delusions are a result of anomalous perceptual experiences through normal reasoning processes. This implies that a delusional belief is not held contrary to evidence but is strengthened by the evidence available (i.e. the anomalous experience). In an attempt to explain the significant, anomalous perceptual experience, normal cognitive activity (i.e. reasoning) is applied. The content of the explanation therefore represents the delusion (Maher, 1974).

A number of studies provide evidence to support this theory. For example, delusions are not limited to one type of disorder but rather can occur in a number of psychological and medical conditions (Maher & Ross, 1984). In non-clinical populations, hearing loss has been found to be linked to paranoia (Zimbardo, Andersen & Kabat, 1981). Ellis, Young, Quayle and de Pauw (1997) found that when Capgras patients and controls were shown pictures of familiar and unfamiliar faces, Capgras patients failed to discriminate between these faces on a measure of skin-conductance response compared to the control participants. However, Maher's theory does not account for all delusions (Garety & Freeman, 1999). Some delusions occur in the absence of an anomalous perceptual experience (Chapman & Chapman, 1988). Additionally, some people have perceptual anomalies but do not develop delusions (e.g. Tranel, Damasio & Damasio, 1995; Vuilleumier, Mohr, Valenza, Wetzel, & Landis, 2003). Peters and Garety (2006) point out that perception is not independent of interpretations, therefore delusions may sometimes influence abnormal perceptual experiences (Slade & Bentall, 1988).

A more recent study examined anomalous perceptual experiences in a large, general population sample and how these relate to beliefs (Pechey & Halligan, 2012). They found that almost half of the sample reported an anomalous perceptual experience and that anomalous experiences moderately and significantly correlated with anomalous beliefs but not with cultural or societal beliefs. Given that a causal effect has been implied between anomalous perceptual experiences and delusional beliefs a disassociation effect between these was also found. Of the 253 participants sampled, 89% moderately or strongly endorsed at least one delusional/ paranormal belief but did not report an anomalous perceptual experience. Conversely, 56% of participants that did not claim to have any anomalous beliefs reported having at least one anomalous experience (Pechey & Halligan, 2012). These findings are of importance since they demonstrate that while a large majority of people report anomalous beliefs alongside anomalous perceptual experiences, not all of them do, suggesting that anomalous perceptual experiences are not necessary for the formation of all types of aberrant beliefs. Indeed, Maher (1999) later acknowledged a potential reasoning impairment in addition to anomalous perceptual experiences to explain delusion formation.

Extending the work of Maher, Coltheart, Menzies and Sutton (2010) put forward a persuasive argument in support of a two-factor theory of delusion formation incorporating anomalous perceptual experiences or what they prefer to term as 'abnormal data' (Factor 1) and a cognitive aspect: namely defective belief evaluation (Factor 2). The two-factor theory of delusion formation has been developed over the last decade and a half (Coltheart, 2007; Coltheart, Langdon & McKay, 2007; Langdon & Coltheart, 2000) and tends to relate solely to monothematic delusions; most commonly the Capgras delusion (see Table 1.1 for example). There are however limitations to this approach. Firstly, it is unclear how this theory relates to polythematic delusions. Some delusions that are frequently seen in clinical patients have not been considered in the two-factor theory (Coltheart, 2013). Additionally it is unclear how a two-factor theory relates to other types of delusional beliefs such as persecutory or grandiose delusions, for example (Miyazono, Bortolotti & Broome, 2015). Coltheart, et al. (2011) have however aimed to address some of these issues associated with applying a two-factor theory to polythematic delusions. For example, there may be many 'first-factors' (anomalous perceptual experiences) that cause polythematic delusions. Polythematic delusions may also form when the first factor is ambiguous and therefore may lend itself to different types of explanations (Miyazono et al. 2015). There is a general consensus that a second factor exists and some state that this is an abnormality in the evaluation of beliefs (Miyazono et al. 2015). What specific kind of abnormality this is, requires further clarification and there seems to be little consensus in the literature regarding the features of this second factor. There is nonetheless consensus that the two distinct factors of the theory have a causal role to play in the formation and maintenance of delusions, with the first factor explaining the content of the delusion and the second factor accounting for the adoption and maintenance of the (delusional) belief.

Corlett et al. (2007), Corlett, Krystal, Taylor and Fletcher (2009) and Corlett, Taylor, Wang, Fletcher and Krystal (2010) posit that delusions are adopted due to aberrant prediction-error signals and that this leads to inappropriate attribution of salience. In this context, prediction-error relates to a mismatch between predictions and experiences. It is theorised that prediction-error signals become excessive in people with delusions. Inappropriate attribution of salience in this context then, relates to giving salience and attention to events that are not at all interesting or merely coincidental but somehow seem to have sudden special meaning to the person (Miyazono et al. 2015) potentially due to the influence of prediction error signals and dopamine dysregulation (Corlett et al., 2009; Kapur, 2003). In this way, delusions may form to explain these odd but meaningful experiences.

There is empirical evidence to support the aberrant prediction-error theory. Corlett et al. (2007) asked participants to learn the association between certain foods and allergic reactions while being monitored by fMRI. Participants were made up of either people with delusions or a control group of non-delusional participants. The activity in the right prefrontal cortex (thought to be a marker of prediction error processing) did not differ with the expectations about allergic reactions in the group of people with delusions despite the expectations differing to either confirm or violate these expectations. There was also evidence that the more severe the delusion, the worse the aberrant prediction error was (Corlett et al., 2007).

There are however limitations to the prediction-error hypothesis. It could be that people experience aberrant prediction error signals but do not develop delusions. It is a core assumption of proponents of the prediction error theory that prediction errors lead to delusions but this may not be the case. As with the two factor theories, people with perceptual anomalies have the same abnormal experience as Capgras patients but still, do not develop a delusion to explain this experience (e.g. Tranel, et al., 1995; Vuilleumier et al., 2003). This theory also needs to explain in more detail how delusions are maintained over time - memory reconsolidation has been proposed as a potential mechanism for this (Corlett et al., 2009).

Schemas, affect and attributional biases

The threat anticipation model (Freeman, 2007; Freeman & Freeman, 2008; Freeman, Garety, Kuipers, Fowler, & Bebbington, 2002) also has perceptual anomalies as a central tenet implicated in the formation of delusional belief (see

Figure 1). Within this model, paranoid (persecutory) delusions are the focus, with several factors of importance including: anomalous experiences, affective processes, reasoning biases and social factors (Freeman et al., 2010). Research has demonstrated, consistent with Maher's account of anomalous perceptions, that internal anomalous experiences are likely to be given a delusional explanation because delusional patients have no alternative explanation for their experience (Freeman et al., 2004). Two out of three studies also found that internal experiences are often cited as evidence to support beliefs in those that are delusional (Buchanan et al., 1993; Freeman et al., 2004; Garety & Hemsley, 1994).

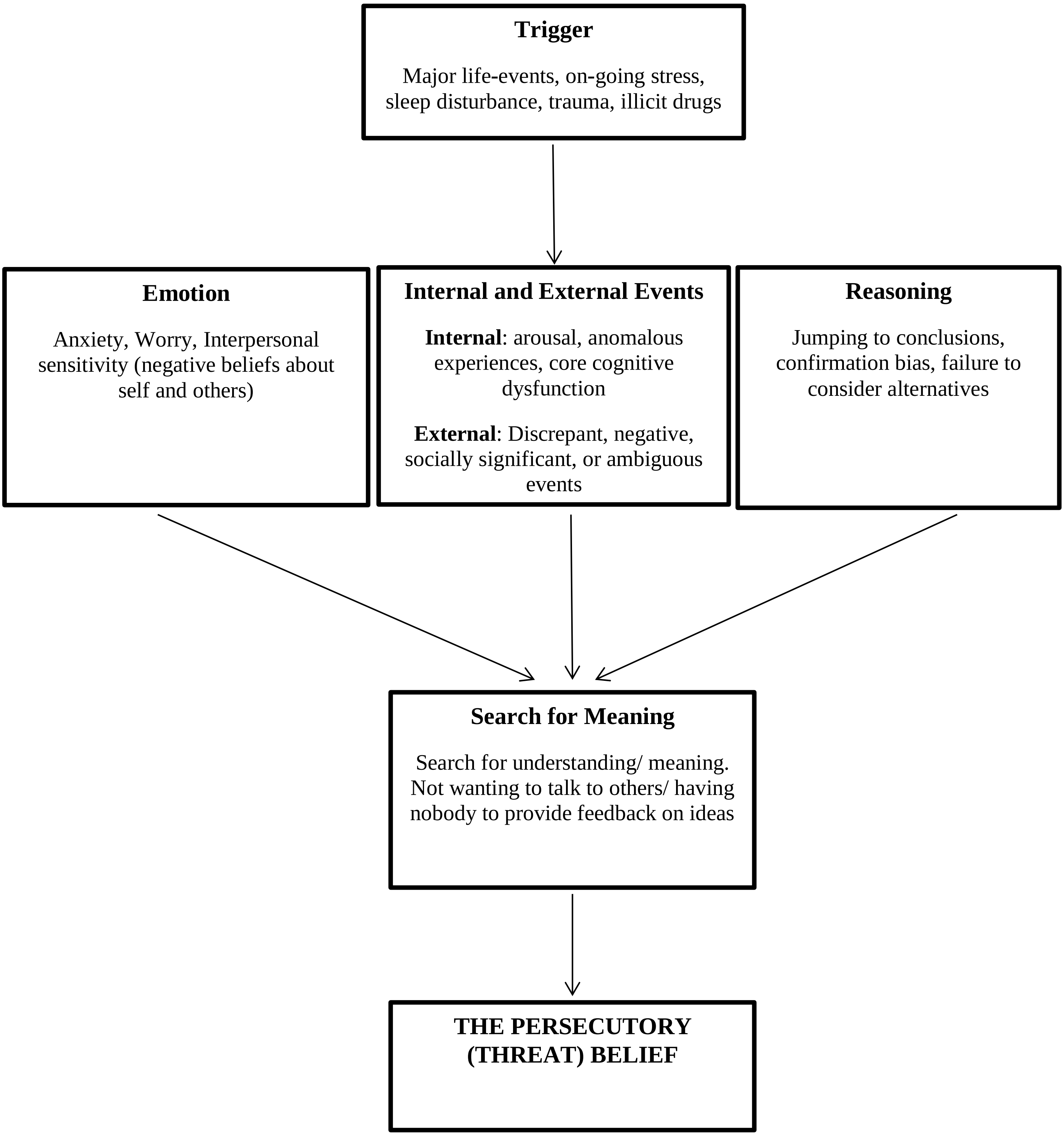

Figure 1. *Factors involved in the development of persecutory delusions (Freeman et al., 2010; Pg. 84.)*

Cognitive-affective processes are also central to this model. Negative cognitions about the self are prevalent in those with paranoid delusions (Collett, Pugh, Waite & Freeman, 2016). The induction of negative self-cognitions led to increased paranoia in those displaying paranoid ideation (Atherton et al., 2016; Freeman et al., 2014) Indeed, paranoia is strongly related to negative-other schemas (e.g. other people are hostile, unforgiving, devious) and negative self-schemas (e.g. I am weak, worthless, vulnerable) (Fowler et al., 2006; Smith et al., 2006). Combined with anxiety (Fowler et al., 2006) these potentially have devastating consequences when considering the effects in a social context and in part, underpin the threat anticipation model proposed by Freeman (2007). Appraising others as hostile and devious and appraising oneself as weak and vulnerable can be a dangerous position leading to the feeling of persistent threat from others (Fowler et al., 2006).

Anxiety and depression are strongly associated with paranoia in both clinical and non-clinical populations (Fowler et al., 2006; Freeman et al., 2005; Johns et al., 2004) and predict the occurrence of paranoid thinking in the general population (Freeman, Pugh & Garety, 2008; Galbraith et al., 2014). Additionally, inducing anxiety had led to the likelihood of paranoid thoughts increasing (Lincoln, Lange, Burau, Exner & Moritz, 2012). With the combination of negative self and negative other schemas and anxiety it seems inevitable that hypervigilance to threat occurs. This is consistent with the findings of Freeman et al. (2013) that patients show greater anticipation of threatening events and that danger is always in mind. Hypervigilance and an attentional bias then, lead to individuals becoming more sensitive to potential threats making false alarms more common. Furthermore, beliefs may be further exacerbated and subsequently consolidated by reasoning biases such as a self-reference bias (Galbraith, Manktelow & Morris, 2008) or a jumping to conclusions reasoning style (Fine, Gardner, Craigie & Gold, 2007; McLean, Mattiske & Blazan, 2017).

Bentall and colleagues (Bentall, & Kaney, 1996; Bentall, Kinderman, & Kaney, 1994; Kinderman & Bentall, 1996; Kinderman & Bentall, 1997; Moritz, Bentall, Kolbeck & Roesch-Ely, 2017) suggest that those with persecutory delusions display attributional biases – an 'externalising' bias whereby self-blame is avoided when negative events occur and a 'personalizing' bias whereby negative events are attributed to others. These biases come into play because of attempts to avoid negative views of the self (self-blame) which may be particularly highlighted when negative events occur. This ensures that fragile self-esteem is protected by essentially projecting negative self-representations onto others. However, maintaining self-esteem in this way comes at the cost of living with negative representations of others as being hostile or devious, for example.

A number of studies have examined the association between persecutory delusions and attributional style with mixed results (Langdon, Still, Connors, Ward & Catts, 2013). An externalising bias has been found for negative events in those with paranoid delusions in comparison to nonclinical controls (Fear, Sharp & Healy, 1996; Lyon, Kaney & Bentall, 1994) however, there have been studies that have failed to replicate these findings (e.g. Martin & Penn, 2002; McKay Langdon & Coltheart, 2005).

Freeman (2007) postulates that an externalising attributional style does not necessarily reflect a defensive account because self-esteem tends to be skewed towards a negative relationship with paranoia. For example, in non-clinical populations, paranoia has been found to correlate with lower self-esteem and higher depression (Ellett, Lopes, & Chadwick, 2003; Freeman et al., 2005a; Fowler et al., 2006; Johns et al., 2004; Martin & Penn, 2001; McKay, et al., 2005) while Smith et al. (2006) found that those with persecutory delusions had lower self-esteem, higher depression and more negative beliefs. This would not be the case if delusions served as a defence mechanism for self-esteem. It seems that the most parsimonious explanation is that paranoia is directly related to lowered self-esteem and increased depression (Freeman, 2007) although causal effects may be hard to determine since the argument is likely to be circular in nature. Low self-esteem and depression are factors related to the formation of paranoid ideas; this in turn may then cause even lower self-esteem and increased depression.

Reasoning

Maher (1974) argued against a cognitive impairment maintaining that there was a lack of evidence for reasoning biases in deluded individuals. However, a large body of evidence has since emerged that challenges this position and suggests that reasoning biases are indeed implicated in delusion formation and maintenance (e.g.

Garety & Freeman, 1999). A number of studies have shown that people with delusions tend to show a 'jump-to-conclusions' (JTC) reasoning style (see Garety & Freeman, 1999; Fine et al., 2007; Garety & Freeman, 2013; McLean et al., 2017; Warman et al., 2007). The JTC bias is based on the notion that decisions are made (or hypotheses are accepted as correct) on the basis of less information compared to controls.

This was first demonstrated by Huq, Garety and Hemsley (1988) using a probabilistic reasoning task developed by Phillips and Edwards (1966) known as the 'beads task'. In this classic experiment of probabilistic reasoning, participants are shown two jars of beads, labelled A and B. The jars contain two different coloured beads in the ratio of 85:15 and 15:85. Participants are made aware of the ratios of beads and the jars are hidden from view. Although participants are told the beads are being drawn randomly, they are drawn in a fixed sequence and replaced after each draw after which participants must decide which jar the experimenter is drawing from. Two versions of this task have typically been employed; 'draws to decision' and 'probability estimates'. This is illustrated in Figure 2.

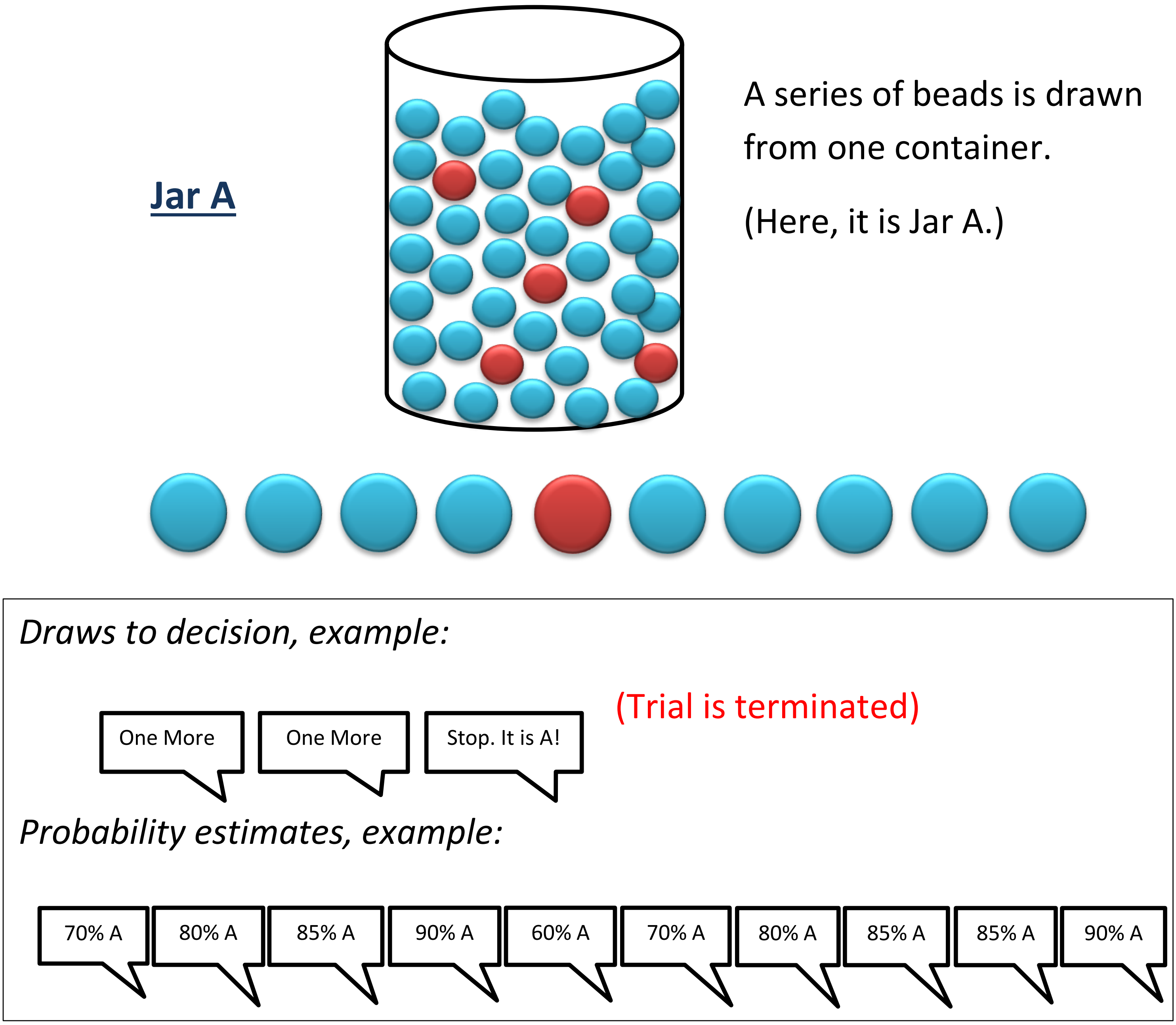

Figure 2: *Illustration of the 'draws to decision procedure' and the 'probability estimates procedure' variation of the beads task. Adapted from Munz (2012).*

Draws to decision allows participants to request as many beads as they wish and the task is only terminated once a decision of which jar is being drawn from is made. Probability estimates involves assigning probabilities at each stage of the sequence for which jar is being drawn from and this has a fixed number of trials. Huq et al. (1988) found, when using the draws to decision paradigm that deluded individuals requested fewer beads before reaching a decision than controls (normal and psychiatric) and displayed greater confidence in their decisions. A number of studies have replicated these findings (Fear & Healy, 1997; Garety, Hemsley & Wessely, 1991; Moritz & Woodward, 2005; Mortimer et al., 1996; Peters, Day & Garety, 1997; see also Ross, McKay Coltheart & Langdon, 2013) with few exceptions (Young & Bentall, 1997). Interestingly, Maher (1992) has argued that the findings of Huq et al. (1988) do not indicate that people with delusions make faulty inferences. Rather, Maher (1992) argues that people with delusions represent better Bayesian reasoning than control groups, with the mean number of draws being 2.2 to reach a decision. After two beads have been drawn that are the same colour, Bayesian probability of the beads coming from the jar with mostly that colour is 97% (Garety & Freeman, 1999; Ross, McKay, Coltheart & Langdon, 2015). Maher (1992) argued that this would be a reasonable point to make a decision and that consequently, the findings fail to demonstrate any faulty inference. However, nearly half in the sample of people with delusions made a decision on the basis of one bead (85% Bayesian probability) which is thought to be very rare in controls (Garety & Freeman, 1999). In contrast, the controls were overcautious in their estimate, which has also been shown previously (Edwards, 1982). In addition, it has been demonstrated that humans are not always strong Bayesian reasoners (Gigerenzer & Hoffrage, 1995).

Nevertheless, the deluded group still consistently based their decisions on less information that controls.

Dudley, John, Young and Over, (1997a) replicated Huq et al's (1988) findings using the draws to decision paradigm but found that deluded participants performed similar to controls on probability estimates. In this study, participants were shown results from a coin-spinning task, where participants estimated the probability of whether the coin was biased to land on heads. No differences were found between groups on this task (Dudley et al., 1997a).

The JTC bias has been shown to be unrelated to impulsiveness, since the deluded group adjusted the amount of evidence required when the ratio of beads was more difficult (60:40) or to a memory deficit, since a memory aid did not change the results (Dudley et al., 1997a). Therefore, the authors concluded that it appears not to be a general reasoning deficit but specific to a data gathering bias (Dudley et al., 1997a). Importantly, this does not demonstrate that those with delusions cannot reason but that there may be specific differences in reasoning that contribute to the formation and maintenance of delusional beliefs (Dudley, Cavanagh, Daley & Smith, 2015).

Using neutral reasoning tasks such as the beads task is thought to be useful because if delusional patients were to reason about delusional materials, this may lead to tautological arguments (why can't they reason, because they are delusional and vice versa; Dudley & Over, 2003). However, when people make decisions in social situations, these decisions have different consequences in comparison to reasoning about beads in a jar. Thus, the beads task has been criticised as lacking ecological validity (Lincoln, Salzmann, Ziegler & Westermann, 2011).

To make reasoning tasks more realistic and relevant to everyday decision making, one study presented participants with neutral and emotionally salient material in the form of surveys about someone very much like the participant (Dudley, John, Young & Over, 1997b). The emotionally salient material appeared to exaggerate the JTC bias and also led to more errors in reasoning for the deluded group, although more errors were made generally with emotionally salient material in all groups (Dudley, et al., 1997b). There is evidence to suggest that the data gathering bias is increased when such methods are employed (Lincoln et al., 2011; Young & Bentall, 1997). Hence, the relevance of this data gathering bias is that the amount of information a person gathers to support an explanation is limited, leading to an early and sometimes inaccurate decision (Aghotor, Pfueller, Moritz, Weisbrod, & Roesch-Ely, 2010) that could potentially contribute towards the formation of a poorly supported, potentially delusional belief. This also means that there are limited attempts to gather other (possibly disconfirmatory) evidence, leading to belief maintenance (Freeman, 2007).

Moritz and Woodward (2004) have argued for a liberal acceptance (LA) account. According to this, those with delusions have a lower threshold of acceptance, suggesting that rather than simply being hasty, deluded patients reach the threshold of what is acceptable evidence for a decision to be made sooner than controls. This, in turn, leads delusional patients to accept implausible ideas more easily. They found that when patients with schizophrenia were shown pictures from the Thematic Apperception Test (Murray, 1943), and asked to rate the plausibility of various interpretations, patients gave relatively high plausibility ratings for those that were rated as poor or unlikely by controls, yet on plausibility ratings that were rated as good or excellent by controls patients were comparable (Moritz & Woodward, 2004). Interestingly, Moritz and Woodward's (2004) findings indicated that liberal acceptance was more pronounced for scenarios that were absurd or less likely and that are usually discounted either through 'common sense' or prior knowledge.

Furthermore, ambiguous situations (rather than situations with only one strong alternative; e.g. the 'beads task') led to increased ambivalence and could delay a decision because of a lower threshold of acceptance (Moritz, Woodward & Lambert, 2007). For example, when the number of jars in the beads task is increased to three rather than two, hasty decision making disappears in delusion-prone participants (Bensi, Giusberti, Nori & Gambetti, 2010). The increased number of alternative jars leads to greater ambiguity, since multiple alternatives cross this lowered threshold of acceptance (however see Broome et al., 2007). The findings of White and Mansell (2009) appear contradictory, with the JTC bias being evident for the two, three and four jar paradigms. They argue that inconsistent findings may be due to differing methodologies – Moritz and colleagues utilise probability or plausibility estimates whereas White and Mansell (2009) argue that it is the decision that is of importance, not how alternatives are evaluated. Liberal acceptance has been demonstrated consistently in further and recent studies (Moritz et al., 2008; Moritz et al., 2009; Moritz et al., 2016).

In a recent study, Moritz and colleagues (Moritz et al., 2016) again tested the liberal acceptance account but replaced jars of beads with herds of sheep. Consistent with previous studies that have demonstrated liberal acceptance (Moritz et al., 2006; Moritz et al., 2007), they found that patients with present or previous delusions had much lower decision thresholds in comparison to the control group (82% vs 93% respectively). This strengthens the liberal acceptance account and means that patients with schizophrenia employ lax criteria for assessing hypotheses which in turn may lead to the acceptance of explanations that are weakly supported. In support of this, few decisions were revised after an initial decision had been endorsed (Moritz et al., 2016).

The studies reviewed have shown that deluded individuals display certain reasoning biases when making decisions. Reasoning biases similar to those found in individuals with delusions have been increasingly detected in the sub-clinical population (e.g., Colbert & Peters, 2002; Galbraith et al., 2008; Galbraith, Manktelow & Morris, 2010; LaRocco & Warman, 2009) supporting a continuum model of psychosis (Ross et al., 2013).

Colbert and Peters (2002) found a JTC bias in a healthy sample of participants who scored highly on a measure of delusional ideation. Freeman, Pugh and Garety (2008) found that the JTC bias was evident in 40 (out of 200) non-clinical participants and that this bias was associated with delusional conviction. Furthermore, Cafferkey, Murphy and Shevlin (2014) found an association between delusional ideation and a JTC bias on the harder version of the beads task (60:40 ratio) but not on the easier version (85:15 ratio). Keefe and Warman (2011) found that stress induction resulted in JTC in delusion-prone participants while in another study, subclinical paranoia led to high prevalence of JTC (Moritz, Quaquebeke & Lincoln, 2012). There are nonetheless studies that have failed to find an association between delusional ideation and a JTC bias (e.g. Ziegler, Rief, Werner & Lincoln, 2008).

Warman et al. (2007) investigated the JTC bias across the continuum of delusional ideation by using deluded individuals as well as delusion prone and non-delusion prone individuals. The tasks used in this study involved a neutral task (the beads task) and a highly self-referent task adapted from Dudley et al's (1997b) survey task. The JTC bias was present for the deluded group on the neutral task but not the delusion prone or non-delusion prone groups. However, they found that the delusional and delusion prone group displayed significantly more confidence in their judgements when the task was emotionally salient than when the task was neutral. This would suggest that confidence in judgements might be critical to understanding the way delusion-prone individuals process information that is self-referent (Warman et al., 2007). This is consistent with the phenomenology literature where schizophrenia is theorized to be underpinned by a disorder of the self, most prominent in the prodromal stage of schizophrenia. This is characterized by hyperreflexivity whereby self-consciousness becomes exaggerated to the point that cognitions and actions become observed, as if detached from the self; with the potential that one's actions become objectified and attributed to external sources (Sass & Parnas, 2003). The findings of Warman et al. (2007) suggest that patients with delusions and delusion-prone individuals exhibit a heightened sense of self-focus in their thinking.

Disorders of the self have further been explored using cognitive approaches. Galbraith et al. (2008) found that individuals high in delusional ideation displayed a self-reference bias in response to everyday arguments, while those low in delusional ideation displayed the opposite effect. Warman and Martin (2006) found that high delusion prone individuals displayed the JTC bias only when the task was emotionally salient and self-referent but not when the task was neutral. The authors contended the judgements that people with delusions make are likely to be emotionally salient in nature, not neutral, therefore these findings are particularly relevant to understanding how those with delusions actually reason about their own delusions (Warman & Martin, 2006).

Aims of the Present Thesis

This thesis aims to make two new contributions to the literature. The first is to test whether liberal acceptance can be demonstrated in non-clinical, delusion-prone participants as opposed to patients. Secondly, this thesis will explore hitherto untested questions as to *why* people with delusional ideas exhibit a liberal reasoning style. This will be done by studying new dimensions on which information is accepted/rejected (e.g. bizarreness and excitement), dimensions that have not previously been tested in relation to the liberal acceptance account.

In Chapters 2-5, narratives containing delusional and neutral content were utilised to examine reasoning and liberal acceptance. This extended the work of LaRocco and Warman (2009) who used narratives with delusional and neutral content and asked participants to rate how likely they thought the narratives were true. If narratives were rated as more likely to be true in the present thesis, this would indicate that they were deemed as more plausible to participants and therefore more likely to be accepted. In the present thesis, this was considered an effective measure of reasoning. Additional variables such as creativity and personality were also examined to determine why those high in delusional ideation liberally accept.

In Chapter 2, the effect of bizarreness and excitement as well as self reference and how disturbing narratives were thought to be was examined. Chapter 3 took an exploratory approach, utilising delusional and neutral narratives as a measure of reasoning but also examining creativity and personality - factors that may account for why a liberal acceptance bias is displayed in those high in delusional ideation. Additionally in Chapter 3, acquiescence bias was examined since it was important to rule out the possibility that liberal acceptance was simply agreement with statements regardless of content. Chapter 4 and 5 examined creativity and apophenia as factors for why people high in delusional ideation liberally accept compared to people low in delusional ideation. Apophenia is the tendency to perceive meaningful patterns or make causal connections where none exist (e.g. coincidental experiences; Fyfe, Williams, Mason & Pickup, 2008). Chapter 6 and 7 utilised materials for examining liberal acceptance that had been used in the published literature (See Moritz & Woodward, 2004; Moritz et al., 2006) with the aim to demonstrate liberal acceptance in a clinical sample. In Chapter 8, a direct comparison between the new materials constructed by the author (Chapter 2-5) and materials used previously in the literature (Chapter 6 and 7) were made. Each experiment will now be reported within this thesis.

Chapter II

Subclinical delusional ideation and likelihood ratings of delusional and neutral narratives

Introduction

LaRocco and Warman (2009) investigated reasoning biases in those high and low in delusional ideation by asking participants to assign ratings to emotionally neutral and delusional narratives. They found that those high in delusional ideation rated delusional narratives as more likely to be true than those low in delusional ideation, yet both groups assigned equivalent ratings for emotionally neutral narratives (LaRocco & Warman, 2009). In other words, those high in delusional ideation were biased to rate unusual scenarios as more likely to be true (see also McGuire, Junginger, Adams, Burright & Donovick, 2001). To put it another way, unusual scenarios surpassed a lower threshold of acceptance, consistent with a LA account (Moritz & Woodward, 2004). It may be that while healthy participants discount stimuli either through common sense or prior knowledge, evidence now suggests that patients with schizophrenia and those that are delusion-prone share common ground in that they demonstrate a more liberal approach to accepting implausible stimuli (Moritz & Woodward, 2004; LaRocco & Warman, 2009).

Liberal acceptance has been demonstrated consistently in patients with schizophrenia (Moritz & Woodward, 2004; Moritz, Woodward & Hausmann, 2006; Moritz, Woodward, Jelinek & Klinge, 2008; Moritz, Woodward & Lambert, 2007) but has not previously been explored in a non-clinical population. Additionally, underpinning factors of why people liberally accept information that others would reject or rate lowly have not been identified.

The first variable examined, in line with LaRocco and Warman (2009), was to explore how likely participants rated narratives containing delusional and neutral themes to be true. In addition, the author is not aware of any studies that have addressed the importance of participants' perceptions of bizarreness of delusional narratives. This question is important for the liberal acceptance account as it could be that delusional scenarios are thought to be less bizarre by delusion prone individuals thus leading to higher ratings of likelihood and greater acceptance of them. As many individuals find their delusional ideas disturbing (e.g. Stanton & David, 2000), participants were asked to rate how disturbing the narratives were. Some authors have theorized that holding divergent beliefs may associate with sensation-seeking and that these beliefs may offer greater excitement than a more rational view of the world (Kumar, Pekala, & Cummings, 1993; Zuckerman, 1979). Hence participants were also asked to rate how exciting the narratives were. Taken together, these questions may offer new insight into the variables underpinning why those with sub-clinical delusional ideation exhibit liberal acceptance. The Peters et al. Delusions Inventory (PDI; Peters et al., 1996) was used to place participants into high and low delusion-prone groups. Five delusional and four neutral narratives were presented and participants were asked to assign ratings of how likely each narrative is true (in accordance with LaRocco & Warman, 2009) but also how bizarre, disturbing and exciting they found each narrative to be.

In light of previous research (LaRocco & Warman, 2009) and the liberal acceptance account (Moritz & Woodward, 2004), it was expected that the high PDI group would rate the delusional (but not neutral) narratives as more likely to be true and less bizarre, compared to the low PDI group. In addition to adding bizarreness, disturbing and excitement ratings, the current study also extended LaRocco and Warman's study by examining the effect of self and other perspectives. Drawing from the work of Galbraith et al., (2008) and Warman et al., (2007) it was predicted that although both groups would show a self-reference bias – higher rating for self-referent perspectives compared to other referent perspectives - it was expected that this bias would be more pronounced in the high PDI group.

Method

Participants

Participants were undergraduate psychology students recruited from a large urban UK university. One-hundred-one participants took part, (83 females; 5 had missing sex data) with a mean age of 21 years 9 months (S.D. = 5 years 1 month). Five participants did not include age data. Participation formed part of their course requirements.

Materials

Participants received an information sheet (Appendix 1), a consent form (Appendix 2) and a demographic form asking for age and sex (Appendix 3).

Delusional Ideation. The Peters et al. Delusions Inventory (PDI; Peters et al., 1996; Appendix 4) is a measure of delusional ideation in the general population. The participant responds to 21 questions with a Yes/No answer. If 'yes' is chosen the participants also indicate on a five-point scale their distress, preoccupation and conviction associated with that belief. For example one question reads - *Do you ever feel as if people are reading your mind?* Scores range from 0 to 336, with higher scores being associated with greater delusional ideation. The PDI has been shown to have good reliability and validity (Peters, Joseph, Day & Garety, 2004).

Narratives. These included five delusional narratives (Appendix 5) based on five types of delusion, namely grandiose, persecutory, reference, bizarre and Schneiderian delusions (e.g. control, thought broadcasting, insertion and withdrawal). The delusional narratives were developed from first person accounts in special issues of Schizophrenia Bulletin (Chapman, 2002; Herrig, 1995; Payne, 1992; Weiner, 2003; Zelt, 1981). For example, the grandiose narrative read:

> *While working, I began to feel that I had such enormous insight into subject areas I hadn't previously studied. I felt as if I possessed a deep knowledge of how certain things in life worked or could work... I began to think of myself as being somewhat special and having a special mind to be thinking these*

things...Because I believed much of my thought-life was entertaining and inventive, I thought I was 'chosen'. I thought I was becoming one of the next sprouting great thinkers endowed with important knowledge... I was going to disregard college classes and jobs and assume my now very important, genius-like self, pursuing the development of new and inventive ideas that would make me highly successful. (Chapman, 2002; p. 546-547).

Four neutral narratives (Appendix 6) were constructed for this study. An example of a neutral narrative was as follows:

A colleague of mine had been looking for a used car. I suggested that she should go to have a look at a car auction because cars are usually quite inexpensive there. She said she would really like a black car. The site where the auction was held was only able to hold 200 cars. On arrival, we noticed the majority of the cars were black. In fact, the auctioneer informed us that 150 of the cars were black and the rest were silver. I said I knew the first car to be shown would be black.

Consideration was given to the length and structure of each narrative to try to maintain consistency. These were ordered with a delusional narrative followed by a neutral narrative and this sequence was fixed. Participants were asked to assign a rating on a five-point scale of how likely the narrative is true, how bizarre they find it, how likely it is that this could happen to them and finally how likely it is that it could happen to most other people.

Participants also completed the Lie Scale from the Eysenck Personality Questionnaire (Eysenck & Eysenck, 1976) to assess participant's truthfulness when completing questionnaires (Appendix 7).

Design

This study employed a mixed design with PDI group (high/ low) being the between groups factor and Narrative (delusional/ neutral) and Perspective (self/ other) being the within groups factors. There were five dependent variables: likelihood of being true, bizarreness, likelihood of happening, exciting and disturbing.

Firstly a 2x2 mixed design ANOVA incorporated PDI group (high/ low) as the between groups factor and narratives (delusional/ neutral) as the within-groups factor. The dependent variable was 'likelihood of being true'. A further series of four 2x2x2 mixed ANOVAs incorporated the same two factors as above in addition to perspective as an additional within groups factor (to self/to most other people). 'Bizarreness', 'likelihood of happening', 'how disturbing' and 'how exciting' were the dependent variables.

Procedure

After informed consent was complete, participants were given a demographics form requiring sex and age and completed the Eysenck Lie Scale. This was followed by the PDI and the delusional and neutral narratives. Delusional narratives were in the order of grandiose, persecutory, reference, Schneiderian and bizarre delusions. These were ordered by presenting a delusional narrative followed by a neutral narrative and this sequence was fixed for all nine narratives. Participants were asked to read each narrative and to circle their answer accordingly. Once the study was complete, participants were verbally debriefed.

Results

Total PDI scores were used to divide participants into high and low scoring groups. A median split was conducted and those scoring up to and including the median of 57 made the low PDI group (n = 51), while those scoring over the median made the high PDI group (n = 50).

Independent *t*-tests revealed no significant PDI group differences in age (t (94) = -1.90; p = 0.06). In addition, no significant difference was found between males and females and PDI score (t (94) = -0.51; p = 0.62). Nor did the PDI groups differ significantly on the Lie Scale (t (99) = 0.68; p = 0.50). (See Table 2.1 for summary statistics).

Table 2.1

Summary statistics for high and low PDI groups

	High PDI Group *(n)*	Low PDI Group *(n)*	PDI *Mean (S.D.)*
Female	41	42	59.87 (37.16)
Male	6	7	54.54 (19.02)
	Mean (S.D.)	*Mean (S.D.)*	-
Age	21.97 (5.61)	23.92 (7.41)	-
PDI Score	86 (27.85)	34.12 (17.16)	-
Lie scale	6.32 (3.87)	6.78 (2.97)	

A two-way mixed design ANOVA was conducted to analyse the likelihood of how true the narratives were rated to be with PDI Group as the between groups factor and Narratives as the within-groups factor. The likelihood ratings (DV) approximated a normal distribution (p = .2; see Appendix 36) and a Levene's test found that the assumption of homogeneity of variance was met for delusional (p = .07) and neutral (p = .07) narratives.

Results revealed a main effect of narrative (F (1, 99) = 463.71; p < 0.01; ηp^2 = 0.82) with the neutral narratives rated higher than the delusional narratives. No significant main effect of PDI group was found (F (1, 99) = 1.15; p = 0.29; ηp^2 = 0.01) nor any significant interaction (F (1, 99) = 1.30; p = 0.26; ηp^2 = 0.01). As can be seen from Table 2.2, the high and low PDI group rated similarly on delusional and neutral narratives.

Table 2.2

Mean values (standard deviation in parenthesis) for how likely the delusional and neutral narratives were true between high and low PDI groups

	Delusional narrative	Neutral narrative	Overall
High PDI group	2.08 (0.72)	3.73 (0.70)	2.91 (0.71)
Low PDI group	1.89 (0.50)	3.72 (0.47)	2.81 (0.49)
Overall	1.99 (0.61)	3.73 (0.59)	2.86 (0.60)

Four 3-way mixed design ANOVAs were also conducted with PDI Group (high/ low) as the between groups factor and Content (delusional/ neutral) and Perspective (self/ other-referent) as the within groups factors. The four dependent variables were ratings of how bizarre, how likely to happen, how disturbing and how exciting the narratives were.

How bizarre?

The first three-way ANOVA examined average ratings of bizarreness of the narratives. A Levene's test found that the assumption of homogeneity of variance was met for both delusional and neutral narratives and self and other ratings (p > .05).

Results revealed a main effect of Content (F (1, 99) = 1002.71; p < 0.01; ηp^2 = 0.91) with the delusional narratives being rated as more bizarre than the neutral narratives (See Table 2.3). No other main effects or interactions were significant for this analysis ($p \geq 0.24$).

Table 2.3

Mean scores (standard deviations in parenthesis) for how bizarre the narratives were rated to be to them or most other people between high and low PDI groups

	High PDI	Low PDI	Overall
Delusional/ Self-Referent	3.95 (0.70)	4.01 (0.71)	3.98 (0.71)
Delusional/ Other-Referent	4.01 (0.61)	3.96 (0.72)	3.99 (0.67)
Neutral/ Self-Referent	1.38 (0.55)	1.57 (0.53)	1.48 (0.54)
Neutral/ Other-Referent	1.37 (0.52)	1.55 (0.65)	1.46 (0.59)
Overall	2.68 (0.60)	2.77 (0.65)	2.73 (0.63)

How Likely to Happen?

The second three-way ANOVA assessed how likely it was that the narratives could happen. Homogeneity of variance between the high and low PDI groups was not met for delusional narratives when participants were asked how likely it was that narratives could happen to oneself (p = .02) or for neutral narratives when asked how likely it was that narratives could happen to others ($p < .01$). Findings related to these should therefore be interpreted with caution.

There was a main effect of PDI group ($F(1, 99) = 4.94$; $p = 0.03$; $\eta p^2 = 0.05$): as shown in Table 2.4 the high PDI group gave higher ratings than the low PDI group. There was also a main effect of Perspective ($F(1, 99) = 70.86$; $p < 0.01$; $\eta p^2 = 0.42$) with the narratives being rated as more likely to happen to most other people than to the self, and a main effect of Content ($F(1, 99) = 477.25$; $p < 0.01$; $\eta p^2 = 0.83$), where neutral narratives were rated higher than delusional narratives. There was also a significant interaction between Content and Perspective ($F(1, 99) = 4.64$; $p = 0.03$; $\eta p^2 = 0.05$). As Table 2.4 shows, other-referent scenarios were judged as more likely than self-referent scenarios, but particularly if they had delusional content. No further interactions achieved significance ($p \geq 0.48$).

Table 2.4

Mean values (standard deviations in parenthesis) of how likely delusional and neutral narratives could happen to them or most other people between high and low PDI groups

	High PDI	Low PDI	Overall
Delusional/ Self-Referent	1.36 (0.46)	1.20 (0.30)	1.28 (0.38)
Delusional/ Other-Referent	1.62 (0.52)	1.42 (0.38)	1.52 (0.45)
Neutral/ Self-Referent	3.23 (0.89)	3.02 (0.75)	3.13 (0.82)
Neutral/ Other-Referent	3.38 (0.87)	3.14 (0.65)	3.26 (0.76)
Overall	2.40 (0.69)	2.20 (0.52)	2.3 (0.61)

To explore the significant interaction between Content and Perspective, follow up analyses (paired samples *t*-test) were conducted. In the first *t*-test, 'self' rating were examined. In the second *t*-test, 'other' ratings were examined.

In the first *t*-test, the difference between delusional and neutral narratives was significant (t (100) = -21.94; p <.01); neutral narratives (M = 3.12; SD = .83) were rated as more likely to happen to the self than delusional narratives (M = 1.28; SD = .39).

In the second *t*-test, there was significant difference between delusional and neutral narratives (t (100) = -20.02; p <.01) with neutral narratives being rated as more likely to happen to others (M = 3.26; SD = .46) than delusional narratives (M = 1.52; SD = .77).

How disturbing?

The third three-way ANOVA tested ratings of how disturbing the narratives were. A Levene's test revealed that the assumption of homogeneity of variance had been met for all between group comparisons (p > .05) except for ratings of how disturbing the neutral narratives were to oneself (p <.05).

Results revealed a main effect of Content (F (1, 99) = 589.80; p < 0.01; ηp^2 = 0.86). As can be seen from Table 2.5, the delusional narratives were rated as more disturbing than the neutral narratives. There was also a main effect of Perspective (F (1, 99) = 35.26; p < 0.01; ηp^2 = 0.26). The narratives were rated as more disturbing to most other people. No other main effects or interactions were significant for this analysis ($p \geq$ 0.15).

Table 2.5

Mean values (standard deviations in parenthesis) for how disturbing delusional and neutral narratives were rated to be to them or to most other people between high and low PDI groups

	High PDI	Low PDI	Overall
Delusional/ Self-Referent	3.19 (0.96)	3.20 (0.88)	3.20 (0.92)
Delusional/ Other-Referent	3.52 (0.81)	3.40 (0.81)	3.46 (0.81)
Neutral/ Self-Referent	1.07 (0.18)	1.23 (0.43)	1.15 (0.31)
Neutral/ Other-Referent	1.35 (0.57)	1.40 (0.47)	1.38 (0.52)
Overall	2.28 (0.63)	2.31 (0.65)	2.30 (0.64)

How exciting?

The final three-way ANOVA tested ratings of how exciting the narratives were (see means in Table 2.6). A Levene's test found that the assumption of homogeneity of variance was met for ratings of delusional narratives (exciting to self p = .07; exciting to others p = .56) but not for ratings of neutral narratives (exciting to self p = .02; exciting to others p <.05). The findings relating to comparisons between the groups on neutral narratives should therefore be interpreted with caution.

Results revealed a main effect of PDI group (F (1, 99) = 5.67; p = 0.02; ηp^2 = 0.05). As can be seen from Table 2.6, the high PDI group gave higher ratings than the low PDI group. There was also a main effect of Content (F (1, 99) = 92.01; p < 0.01; ηp^2 = 0.48): the delusional narratives were rated as more exciting than the neutral narratives. There was a main effect of Perspective (F (1, 99) = 10.91; p < 0.01; ηp^2 = 0.10): narratives were rated as more exciting to most other people than to oneself. In addition, a three - way interaction between the factors was found to be approaching significance (F (1, 99) = 3.63; p = 0.06; ηp^2 = 0.06). Although the low PDI group rated all narratives as more exciting to most other people, the high PDI group regarded delusional narratives (but not neutral) as equally exciting to themselves and most other people.

Table 2.6

Mean values (standard deviations in parenthesis) for how exciting delusional and neutral narratives were rated to be to them or to most other people between high and low PDI groups

	High PDI	Low PDI	Overall
Delusional/ Self-Referent	2.85 (0.86)	2.48 (0.82)	2.67 (0.84)
Delusional/ Other-Referent	2.85 (0.73)	2.66 (0.77)	2.76 (0.75)
Neutral/ Self-Referent	1.78 (0.78)	1.63 (0.54)	1.71 (0.66)
Neutral/ Other-Referent	2.04 (0.89)	1.78 (0.58)	1.91 (0.74)
Overall	2.38 (0.82)	2.14 (0.68)	2.26 (0.75)

Discussion

The first prediction was that compared to the low PDI group, the high PDI group would rate delusional narratives as more likely to be true. Instead, the high PDI group rated both delusional and neutral scenarios as more likely to be true compared to the low PDI group, although this difference was too subtle to be significant. These findings appear partly inconsistent with LaRocco and Warman, (2009) who only found higher ratings of likelihood from delusion-prone participants on delusional narratives. In contrast to this, the data suggests that high PDI scorers have a general tendency to rate all scenarios as more likely/true. It is tentatively argued that this is in line with Moritz and Woodward's (2004) notion of the liberal acceptance bias. In the high PDI group, both neutral and delusional narratives may have surpassed a lower threshold of acceptance, making them appear more plausible and thus more likely or more true. This is a unique finding, since the liberal acceptance bias has previously only been observed on implausible material, but here it has also been observed it in relation to neutral material, suggesting – in subclinical delusions at least - that this lower threshold of plausibility extends beyond delusional material to neutral information. These findings should however be interpreted with caution given that statistical significance was not achieved.

In line with LaRocco and Warman's (2009) study, it was predicted that high PDI scorers may rate delusional narratives as less bizarre. However, this prediction was not upheld. Ratings of how bizarre or how disturbing did not differentiate the PDI groups. The high PDI group rated narratives as more exciting than the low PDI group, but in particular, the high PDI scorers found delusional narratives more exciting from a personal perspective compared to the low PDI scorers. This supports the theory that some find greater excitement in unusual beliefs as opposed to a more rational view of the world and that this may associate with sensation seeking (Kumar et al., 1993; Zuckerman, 1979) in those that are delusion-prone. This finding is also consistent with research highlighting arousal abnormalities in delusional patients (Mujica-Parodi, Corcoran, Greenberg, Sackeim & Malaspina, 2002) and delusion-prone participants (Kéri, Seres, Kelemen & Benedek, 2011).

These findings provide tentative new evidence not only that a liberal acceptance bias is evident in delusion-prone individuals, but also that this bias potentially extends to neutral information and that inflated estimates of likelihood and feelings of excitement may be reasons *why* such individuals have a more liberal threshold of acceptance. In Chapter 3, the aim was to replicate these findings but also to employ an exploratory approach and test a range of variables that may offer alternative explanations to the liberal acceptance account.

Chapter III

Personality, creativity, sensation seeking, acquiescence and reasoning as underpinning factors of delusional ideation

Introduction

The present chapter aimed to replicate the findings of Chapter 2 but also to examine other variables that may offer alternative explanations for the findings besides liberal acceptance.

The first aim was to investigate earlier findings that high PDI scorers find excitement in delusional stimuli. To explore this, the Sensation Seeking Scale Form V (Zuckerman, 1994) was employed to measure high and low PDI scorers' interests and preferences. The second aim was to investigate the relationship between delusional ideation and creativity. Evidence suggests that schizotypal personality traits are associated with creativity (see Nettle, 2006 and Fink et al., 2014). Schuldberg (1988; 1990; 2000) has shown that self-report measures of creativity and scales to measure liability to psychiatric symptoms are correlated, particularly measures relating to the positive symptoms of psychotic illness (i.e. delusions and hallucinations). Furthermore, those who score highly on scales measuring positive psychotic symptoms have been found to make more semantic associations (Mohr, Graves, Gianotti, Pizzagalli, & Brugger, 2001). Both creativity and the psychosis continuum are related to cognition and thus creativity may be a factor in why delusion-prone individuals see plausibility where others do not. In the current study, three measures of creativity were employed to investigate the relationship between those high in delusional ideation and creativity. Gough's Creative Personality Scale (Gough, 1979) is a self-report measure of creativity. This measure has been shown to be a valid predictor of a 'creative personality' (e.g. Carson, Peterson & Higgins, 2005). In addition, the Novelty sub-scale of the Emotional Creativity Inventory (ECI; Averill, 1999) was employed. When examining emotions and creativity, a link has been identified between creativity and affective disorders (Ivcevic, Brackett & Mayer, 2007). This link may be due to the individual experiencing strong positive emotions or even mild mania which is thought to increase awareness and enhance flexibility in thinking (Ivcevic et al., 2007). Those who reported high scores of hypomania in a student sample described themselves as unique and creative and reported engaging in more fantasy activities (Shuldberg, 1990). Furthermore, the Emotional Creativity Inventory has been found to correlate negatively with alexithymia (difficulty in experiencing, expressing, and describing emotional responses) and positively with fantasy proneness (Fuchs, Kumar & Porter, 2007). Finally, the Remote Associate Test (RAT; Mednick, 1962) was employed as a measure of convergent thinking, thought to be essential to creativity (Guilford, 1967).

The third aim was to investigate the relationship between personality, subclinical delusional ideation and ratings of narratives. Previous studies have investigated personality in relation to the positive and negative symptoms of schizotypy. For example, Ross, Lutz and Bailey (2002) found that positive symptoms of schizotypy were predicted by Neuroticism, Openness and Agreeableness. Larøi, DeFruyt, van

Os, Aleman and Van der Linden (2005) investigated the association between personality and delusion-proneness in a young (18-30) and elderly (60-75) sample. They found that Openness to Experience, Neuroticism and Agreeableness significantly correlated with total PDI score in the young sample whereas, in the elderly sample, Openness to Experience alone significantly correlated with total PDI score. In the present study, the 20-Item Mini IPIP (Donnellan, Oswald, Baird & Lucas, 2006) was employed to test whether the five factors of personality were able to further explain higher ratings for the narratives employed. In particular, it may be that openness to experience (imaginative, unconventional and willing to embrace new ideas; e.g. Costa & McCrae, 1992) may explain a greater willingness to endorse narratives as more likely and exciting.

It has been argued in this thesis that high PDI scorers' higher ratings of scenarios could indicate a liberal acceptance bias and hence a vulnerability to endorse information that others would reject or rate lowly. However, these findings could be due to mere acquiescence bias (the tendency to agree with questionnaire statements regardless of content; Winkler, Kanouse & Ware, 1982). Acquiescence bias was hence tested to examine if high PDI scorers are generally more inclined to agree or approve. A scale containing matched pairs of logically opposite items was used to measure acquiescence response bias. Acquiescence is indicated by endorsement of two opposing items.

Based on previous literature and findings from Chapter 2, it was expected that those high in delusional ideation would replicate previous results in terms of rating neutral and delusional narratives as more likely to be true and more likely to happen than the low PDI group. In addition, it was expected that the high PDI group would rate the delusional narratives as more exciting compared to the low PDI group. Finally, regression and mediation analyses will explore whether measures of creativity, personality, dis-inhibition, experience seeking, boredom susceptibility and response acquiescence could explain why high PDI scorers gave higher ratings for scenarios.

Method

Participants

Participants were undergraduate psychology students recruited from a large urban UK University. Sixty-five participants took part, (32 females; 29 participants had missing sex data). The mean age was 22 years 2 months (S. D. 7 years 8 months). Thirty participants did not include age data. Participants were recruited via an online system and took part voluntarily and gained course credits for their participation.

Design

ANOVAs. Chapter 3 employed a mixed design with PDI group (high/ low) being the between-groups factor and Narratives (delusional/ neutral) and Perspective (self/ other) as within-group factors. The dependent variables were: likelihood of being true, bizarreness, likelihood of happening, how exciting and how disturbing.

Multiple regression and mediation. A multiple linear regression was also employed to test whether a set of predictors (PDI group, dis-inhibition, experience seeking, boredom susceptibility, Creative Personality Scale, Remote Associates Test, Emotional Creativity Inventory, response acquiescence, openness, conscientiousness, extraversion, agreeableness and emotional stability), could predict narrative ratings. Significant predictors were then tested as mediators of the relationship between PDI group and narrative ratings, in order to see whether these variables could explain *why* PDI group was related to narrative ratings.

Materials

After informed consent (Appendix 8 & 9), participants completed the Peters et al. Delusions Inventory (PDI; Peters *et al.*, 1996; Appendix 4) and assessed five delusional (Chapman, 2002; Herrig, 1995; Payne, 1992; Weiner, 2003; Zelt, 1981; Appendix 5) and four neutral narratives (Appendix 6) as well as the lie scale from the Eysenck Personality Questionnaire (EPQ; Eysenck & Eysenck, 1976; Appendix 7), identical to Chapter 2.

Sensation Seeking. In addition, participants completed the Dis-inhibition, Experience Seeking and Boredom Susceptibility sub-scales of the Sensation Seeking Scale Form V (Zuckerman, 1994; Appendix 10). This contains ten items in each subscale and requires participants to choose between two options. For example, for Boredom Susceptibility, one item reads;

A. *There are some movies I enjoy seeing a second or even third time**
B. *I can't stand watching a movie that I've seen before**

Participants are required to choose one option from the two presented.

Creativity. Gough's (1979) Creative Personality Scale (Appendix 11) is a check-list of items where participants indicate which adjectives best describe them. Eighteen items are indicative of a creative personality, while 12 are contraindicative. This includes adjectives such as: capable, cautious, confident and conservative. A higher score indicates higher creativity.

The Novelty sub-scale of the Emotional Creativity Inventory (Averill, 1999; Appendix 12) contains 14 items measuring novel emotional creativity. For example, one item measuring emotional novelty is: *My emotional reactions are different and unique.* Items are rated on a scale of 1 *(If the statement is much less true of you than of the average person or if you strongly disagree with the statement)* to 5 *(If the statement is much more true of you than of the average person, or if you strongly agree with the statement).*

The Remote Associate Test (RAT; Mednick, 1962; Appendix 13) involves finding a solution to a triad of unrelated words. For example, if presented with the triad of words consisting of Broken, Clear and Eye the associated word would be Glass (Broken glass/ Clear glass/ Glass eye). Higher scores indicate higher creativity.

Acquiescence Bias. To measure response acquiescence twelve matched pairs of logically opposite items were presented to participants in a random order. This was proposed by Winkler, Kanouse and Ware (1982) and is a method to detect acquiescence response bias, i.e. the tendency to agree with questionnaire statements regardless of content. Examples of pairs of logically opposed items are;

1. *Prescription drugs frequently do more harm than good.*

   Prescription drugs are almost always helpful.

2. *Good health is largely a matter of luck.*

   When it comes to health there is no such thing as bad luck.

These were presented in a random order and are then scored from the frequency with which participants agree with pairs of items that are logically opposite (Appendix 14).

Personality. The 20-item mini-IPIP consists of twenty items measuring extraversion, agreeableness, conscientiousness, neuroticism and openness to experience (Donnellan, et al., 2006; Appendix 15). For example, for extraversion, one statement reads; Am the life of the party. Participants rate on a 5-point scale how well each statement describes them from 1 (very inaccurate) to 5 (very accurate).

Procedure

Once informed consent was complete participants were presented with a questionnaire pack. Questionnaires were presented in a fixed order. Participants firstly assigned ratings to the delusional and neutral narratives as in Chapter 2. Participants then completed the Eysenck Lie Scale (Eysenck & Eysenck, 1976) followed by the Dis-inhibition, Experience Seeking and Boredom Susceptibility sub-scales of the Sensation Seeking Scale Form V (Zuckerman, 1994). This was followed by Gough's Creative Personality Scale, the Remote Associate Test (Mednick, 1962) was presented next to act as an interval between rating scales. Participants then went on to complete the Novelty subscale of the Emotional Creativity Inventory (Averill, 1999), a questionnaire measuring response acquiescence (Winkler et al., 1983), the 20-Item Mini IPIP (Donnellan, et al., 2006) and the PDI (Peters et al., 1996).

Once the questionnaire pack was complete, participants were given a verbal debrief of the study.

Results

Total PDI scores were used to divide participants into high and low scoring groups. A median split was conducted and those scoring up to and including the median of 48 comprised the low PDI group (n = 33) while those scoring above the median comprised the high PDI group (n = 32). Independent t-tests revealed no significant PDI group differences in age (t (33) = 1.70; p = 0.10). In addition, no significant difference was found between males and females and PDI score (t (34) = 0.05; p = 0.30). There was also no significant difference between PDI scorers on the lie scale (t (63) = -1.20; p = 0.24) (See Table 3.1).

Table 3.1

Summary statistics for high and low PDI groups

	High PDI Group *(n)*	Low PDI Group *(n)*	PDI *Mean (S.D.)*
Female	15	17	52.31 (42.44)
Male	3	1	71.5 (26.86)
	Mean (S.D.)	*Mean (S.D.)*	-
Age	20.22 (1.40)	24.18 (9.78)	-
PDI Score	88.03 (34.71)	24.88 (14.13)	-
Lie scale	7.31 (5.25)	5.97 (3.7)	

Note: Fourteen responses in the high PDI group and fifteen responses in the low PDI group were missing for sex of participants. Fourteen responses in the high PDI group and sixteen responses in the low PDI group were missing for age.

A two-way mixed design ANOVA was conducted to analyse the likelihood of how true the narratives were. The likelihood ratings (DV) approximated a normal distribution (p = .2; see Appendix 36). A Levene's test found that the assumption of homogeneity of variance was met for neutral narratives (p = .83) however this was not met for the comparison on delusional narratives (p = .04) - caution should therefore be employed in any interpretation.

Results revealed a main effect of PDI group (F (1, 63) = 4.04; p = 0.05; ηp^2 = 0.06) with the high PDI group giving higher ratings than the low PDI group. There was a main effect of narrative (F(1, 63) = 161.17; p < 0.01; ηp^2 = 0.72). As can be seen from Table 3.2, the neutral narratives were rated as more likely to be true than the delusional narratives. The interaction was not significant (F (1, 63) = 0.25; p = 0.62; ηp^2 = 0.004).

Table 3.2

Mean values (standard deviation in parenthesis) for how likely the delusional and neutral narratives were true between high and low PDI groups

	Delusional narrative	Neutral narrative	Overall
High PDI group	2.03 (0.72)	3.47 (0.74)	2.75 (0.73)
Low PDI group	1.71 (0.56)	3.27 (0.80)	2.49 (0.68)
Overall	1.87 (0.64)	3.37 (0.77)	2.62 (0.71)

Four 3-way mixed design ANOVAs were also conducted with PDI Group (high/ low) as the between-groups factor and Content (delusional/ neutral) and Perspective (self/ other referent) as the within-groups factors. The dependent variables for each of the four 3-way ANOVAs were ratings of how bizarre, how likely to happen, how disturbing and how exciting.

How bizarre?

The first three-way ANOVA examined average ratings of bizarreness of the narratives. Homogeneity of variance was met for all comparisons (p > .05). There was no main effect of PDI group (F (1, 63) = 3.189; p = 0.08; ηp^2 = 0.05). There was a main effect of Content (F (1, 63) = 315.190; p < 0.01; ηp^2 =0.833) with the delusional narratives rated higher than the neutral narratives. There was a main effect of Perspective (F (1, 63) = 5.467; p = 0.02; ηp^2 = 0.08). Narratives were rated as more bizarre to the self than to most other people (See Table 3.3). There were no other significant findings for this analysis ($p \geq 0.11$).

Table 3.3

Mean scores (standard deviations in parenthesis) for how bizarre the narratives were rated to be to them or most other people between high and low PDI groups

	High PDI	Low PDI	Overall
Delusional/ Self-Referent	3.78 (0.69)	4.12 (0.89)	3.95 (0.79)
Delusional/ Other-Referent	3.53 (0.83)	4.01 (0.75)	3.77 (0.79)
Neutral/ Self-Referent	1.74 (0.72)	1.77 (0.81)	1.76 (0.77)
Neutral/ Other-Referent	1.65 (0.68)	1.64 (0.69)	1.65 (0.69)
Overall	2.68 (0.73)	2.89 (0.79)	2.79 (0.76)

How likely to happen?

The second three-way ANOVA assessed how likely it was that the narratives could happen. Homogeneity of variance was met for all comparisons ($p > .05$). Results revealed no main effect of PDI group (F (1, 63) = 1.064; $p = 0.31$; $\eta p^2 = 0.02$). There was a main effect of Content (F (1, 63) = 200.042; $p < 0.01$; $\eta p^2 = 0.760$) with the neutral narratives being rated higher than the delusional narratives. There was a main effect of Perspective (F (1, 63) = 17.340; $p < 0.01$; $\eta p^2 = 0.216$). The narratives were rated as more likely to happen to most other people than to themselves. The interaction was also significant between Content and Perspective (F (1, 63) = 12.128; $p < 0.01$; $\eta p^2 = 0.161$). Neutral narratives were rated as more likely to happen to most other people (See Table 3.4). No other interactions were significant for this analysis ($p \geq 0.56$).

Table 3.4

Mean values (standard deviations in parenthesis) of how likely delusional and neutral narratives could happen to them or most other people between high and low PDI groups

	High PDI	Low PDI	Overall
Delusional/ Self-Referent	1.38 (0.37)	1.30 (0.37)	1.34 (0.37)
Delusional/ Other-Referent	1.66 (0.55)	1.54 (0.52)	1.60 (0.54)
Neutral/ Self-Referent	3.12 (0.85)	2.99 (0.92)	3.05 (0.88)
Neutral/ Other-Referent	3.19 (0.82)	3.02 (0.92)	3.11 (0.87)
Overall	2.34 (0.65)	2.21 (0.68)	2.27 (0.66)

To explore the significant interaction between Content and Perspective, follow up analyses (paired samples *t*-test) were conducted. In the first *t*-test, 'self' rating were examined. In the second *t*-test, 'other' ratings were examined.

In the first *t*-test, the difference between delusional and neutral narratives was significant ($t\,(64) = -15.18$; $p < .01$); neutral narratives (M = 3.05; SD = .88) were rated as more likely to happen to the self than delusional narratives (M = 1.34; SD = .37).

In the second *t*-test, there was significant difference between delusional and neutral narratives (t (64) = -12.46; p <.01) with neutral narratives being rated as more likely to happen to others (M = 3.10; SD = .87) than delusional narratives (M = 1.6; SD = .53).

How disturbing?

The third three-way ANOVA tested ratings of how disturbing the narratives were. Homogeneity of variance was met for all comparisons ($p > .05$). There was no main effect of PDI group (F (1, 63) = 1.688; $p = 0.20$; $\eta p^2 = 0.026$). There was a main effect of Content (F (1, 63) = 215.046; $p < 0.01$; $\eta p^2 = 0.773$). As can be seen from Table 3.5, the delusional narratives were rated higher than the neutral narratives. There was a main effect of Perspective (F (1, 63) = 4.541; $p = 0.04$; $\eta p^2 = 0.067$) with the narratives being rated as more disturbing to most other people. There was a significant interaction between Content and Perspective (F (1, 63) = 4.716; $p = 0.03$; $\eta p^2 = 0.070$). Delusional narratives were rated as more disturbing to most other people. No other findings were significant for this analysis ($p \geq 0.14$).

Table 3.5

Mean values (standard deviations in parenthesis) for how disturbing delusional and neutral narratives were rated to be to them or to most other people between high and low PDI groups

	High PDI	Low PDI	Overall
Delusional/ Self-Referent	2.93 (0.96)	3.28 (0.98)	3.11 (0.97)
Delusional/ Other-Referent	3.26 (0.81)	3.58 (0.93)	3.42 (0.87)
Neutral/ Self-Referent	1.30 (0.48)	1.59 (1.43)	1.45 (0.96)
Neutral/ Other-Referent	1.54 (0.70)	1.39 (0.46)	1.47 (0.58)
Overall	2.26 (0.74)	2.46 (0.95)	2.36 (0.85)

Follow up analyses (paired samples *t*-test) were conducted to explore the significant interaction between Content and Perspective. In the first *t*-test, 'self' rating were examined. In the second *t*-test, 'other' ratings were examined.

In the first *t*-test, the difference between delusional and neutral narratives was significant (t (64) = -10.6; p <.01); delusional narratives (M = 3.11; SD = .98) were rated as more disturbing to the self than neutral narratives (M = 1.45; SD = 1.08).

In the second *t*-test, there was significant difference between delusional and neutral narratives (t (64) = 15.77; p <.01) with delusional narratives being rated as more disturbing to others (M = 3.42; SD = .88) than neutral narratives (M = 1.46; SD = .59).

How exciting?

The final three-way ANOVA tested ratings of how exciting the narratives were. Homogeneity of variance was met for all comparisons ($p > .05$) except for ratings of excitement to self for neutral narratives ($p = .03$). Results revealed that the main effect of PDI group was approaching significance ($F(1, 63) = 3.55$; $p = 0.06$; $\eta p^2 = 0.05$). The high PDI group were giving higher ratings than the low PDI group. There was a main effect of Content ($F(1, 63) = 12.45$; $p < 0.01$; $\eta p^2 = 0.165$). As can be seen from Table 3.6, delusional narratives were rated as more exciting than neutral narratives. There was a main effect of Perspective ($F(1, 63) = 19.49$; $p < 0.01$; $\eta p^2 = 0.236$) with the narratives being rated as more exciting to most other people than to the self. None of the interactions were significant for this analysis ($p \geq 0.20$).

Table 3.6

Mean values (standard deviations in parenthesis) for how exciting delusional and neutral narratives were rated to be to them or to most other people between high and low PDI groups

	High PDI	Low PDI	Overall
Delusional/ Self-Referent	2.31(0.85)	2.14 (0.77)	2.23 (0.81)
Delusional/ Other-Referent	2.59 (0.79)	2.38 (0.79)	2.49 (0.79)
Neutral/ Self-Referent	1.97 (0.90)	1.67 (0.63)	1.82 (0.77)
Neutral/ Other-Referent	2.14 (0.87)	1.82 (0.71)	1.98 (0.79)
Overall	2.25 (0.85)	2.00 (0.73)	2.13 (0.79)

A multiple linear regression incorporated predictors in two blocks. Block 1: PDI group; block 2: dis-inhibition, experience seeking, boredom susceptibility, Creative Personality Scale, Remote Associates Test, Emotional Creativity Inventory, response acquiescence, openness, conscientiousness, extraversion, agreeableness and emotional stability. The dependent variable was overall ratings of how likely to be true. Only being in the high PDI group and having high agreeableness predicted high ratings of how likely to be true (F (2, 62) = 5.16, p=.008; R^2 = .143). A subsequent bootstrapped mediation analysis revealed that agreeableness did not mediate the relation between PDI group and ratings of likely to be true (b = .002; SE = .04; 95% CI, -.08 to .11).

A second multiple regression incorporated the same predictors but this time with overall ratings of how exciting as the dependent variable. Being in the high PDI group and having lower RAT scores predicted ratings of how exciting the narratives were (F (2, 62) = 5.14, p=.009; R^2 = .142). In a subsequent bootstrapped mediation analysis, there was a fully mediated indirect effect, showing that the relation between PDI group and ratings of how exciting were fully mediated by RAT scores (b = .12; SE = .06; 95% CI, .03 to .27). Thus lower RAT scores explain why high PDI scorers rated the scenarios as more exciting. Figure 3 displays the relationships from this significant mediation analysis.

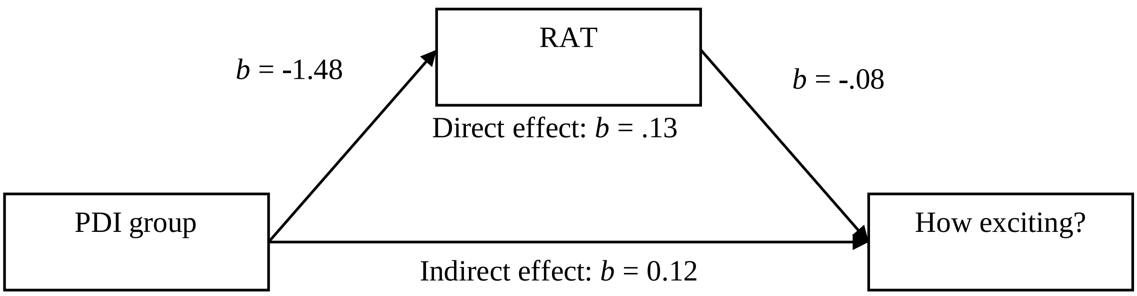

Figure 3. *The direct and indirect pathways showing PDI group as a predictor of 'how exciting', mediated by RAT scores, with unstandardised b weights.*

Discussion

High PDI scorers gave higher ratings of 'how likely to be true' narratives were. Both groups rated neutral narratives as more likely/ true but high PDI scorers still gave higher ratings to both scenarios than low PDI scorers. This supports the findings from Chapter 2 but only partially supports LaRocco and Warman (2009) in that high PDI scorers demonstrate a liberal acceptance bias for scenarios containing both delusional and neutral content as opposed to delusional scenarios alone. This implies a lowered threshold of acceptance for scenarios generally consistent with a liberal acceptance account (Moritz & Woodward, 2004; Moritz et al., 2006; Moritz et al., 2008; Moritz et al., 2007).

The prediction that the high PDI group would rate narratives as more likely to happen was not supported. Instead, both groups rated neutral narratives as more likely to happen to most other people. The high PDI group did show a subtle self-reference effect compared to the low PDI group, consistent with previous research (Galbraith et al., 2008; Warman et al., 2007) but this difference was too slight to be significant.

Consistent with Chapter 2, high PDI scorers rated delusional narratives as more exciting, but this did not achieve significance. This may suggest that holding unusual beliefs offers greater excitement (Kumar et al., 1993; Zuckerman, 1979) however the data does not indicate that high ratings of the scenarios' excitement was due to sensation seeking since no such association was found. This implies that there is something specific about delusional stimuli that affect high PDI scorers' excitement and not a general tendency to seek excitement in all areas of life.

Although rating how true or exciting the scenarios were, did not associate with two of the creativity measures, (Creative Personality Scale, Emotional Creativity Inventory), the RAT did predict exciting ratings. This was a negative relationship, suggesting that high PDI scorers were rating scenarios as exciting perhaps because of low RAT scores (NB low RAT scores indicate high cognitive looseness). Some authors have argued that those low in delusional ideation have greater cognitive inhibition and thus perform better on convergent thinking tasks such as the RAT because it requires a narrow and focused type of thinking (Davidson-Jenkins, 2003) and the findings support this position. Hence, low scores on the RAT would suggest 'cognitive looseness' in high PDI scorers and conversely cognitive inhibition in low PDI scorers. No significant associations were found between PDI group and any of the five factors of personality. It has been argued in this thesis that high PDI scorers rate scenarios more highly because of liberal acceptance; no relationship between scenario ratings and response acquiescence was found, which eliminates this as an alternative explanation for high PDI scorers' ratings.

Thus Chapter 3 confirms earlier findings that likelihood and potentially excitement might be two important indices which may contribute to liberal acceptance of information by delusion prone individuals. Besides the role of low RAT scores in explaining the relation between delusional ideation and 'exciting' ratings, attempts to explore further variables which may explain that relation proved largely unsuccessful.

Nonetheless, these experiments offer new insight into the judgements that delusion-prone individuals may use when liberally accepting information: how likely it is of being true or of happening and how exciting it may be to them – these are important dimensions by which delusion-prone people judge plausibility and offer new reasons *why* they liberally accept.

In Chapter 4, liberal acceptance, creativity and 'cognitive looseness' were investigated to address the previous finding that those high in delusional ideation may exhibit a 'loose' or disinhibited cognitive style and to investigate additional variables that may explain a lowered threshold of acceptance in subclinical delusional ideation.

Chapter IV

Delusional thinking and reasoning: The effect of creativity and apophenia

Introduction

It has been argued in this thesis that 'likelihood of being true' and 'excitement' appear to be important factors for understanding why those that are high in delusional ideation liberally accept. In Chapter 4, again reasoning was examined in order to replicate previous findings that those high in delusional ideation rate narratives with delusional and neutral content as more likely to be true and exciting compared to those low in delusional ideation. From the findings of Chapter 3, it also seems that those high in delusional ideation employ a 'looser' cognitive style and this may provide a mechanism by which information may surpass a lowered threshold for plausibility. Indeed, it appears that in those high in delusional ideation, several competing options may surpass this lowered threshold of acceptance (Moritz et al., 2007), resulting in scenarios being rated as more likely to be true and thus accepted. This also means that performance on tasks such as the RAT is not as adept in those high in delusional ideation as those low in delusional ideation. Those low in delusional ideation appear to display a degree of cognitive inhibition (as opposed to cognitive 'looseness') and thus perform better on convergent thinking tasks. Furthermore, this is consistent with literature demonstrating that those high in delusional ideation are resistant to focus down to a final hypothesis (Young & Bentall, 1995).

Creativity may play an important part in the acceptance of implausible information. For example, one study has demonstrated that positive schizotypy and creativity can partly account for why some scientists hold religious beliefs and still have a high commitment to empiricism (MacPherson & Kelly, 2011), while other authors maintain that holding religious beliefs directly conflict with a scientific stance (e.g. Dawkins, 2006).

In the present study, two measures of creativity were employed to investigate the relationship between those high in delusional ideation and creativity. The Novelty sub-scale of the Emotional Creativity Inventory (Averill, 1999) was again employed, since novelty is an often associated criterion for creativity. For the purpose of the Emotional Creativity Inventory, an emotionally creative response can be novel in comparison to an individual's usual behaviour or novel in comparison to the typical behaviour in a society (Averill, 1999; Humphreys, Jiao & Sadler, 2008). Furthermore, increased awareness and enhanced flexibility in thinking has previously been associated with emotionally creative responses (Ivcevic et al., 2007). In addition to the Emotional Creativity Inventory, the Remote Associate Test (RAT; Mednick, 1962) was again employed as a measure of convergent thinking, thought to be essential to creativity (Guildford, 1967).

Consistent with the notion of cognitive 'looseness', previous research (Brugger et al., 1993) has found that people high on the Magical Ideation Scale were able to see more meaningful patterns in a visual display of random dots. While Farias, Claridge and Lalljee (2005) found that schizotypy was associated with participants finding complex types of visual patterns (static or moving people, animals, objects and landscapes etc.) in visual displays of random dots. Fyfe and colleagues (2008) have therefore suggested that apophenia (the tendency to perceive meaningful patterns and causal connections where none exist; Fyfe et al., 2008) may be a contributing factor to the formation of paranormal as well as delusional beliefs. In light of these findings, an experimental task known as the Snowy Pictures Task (Ekstrom, French, Harman, & Dermen, 1976) was also employed to measure cognitive 'looseness' or looseness of associations in those high in delusional ideation and to identify if this contributes to an increased risk for developing delusional beliefs.

In addition to the above measures, the Eysenck Lie Scale (Eysenck & Eysenck, 1976) was employed to measure participants' truthfulness when completing questionnaires. This is primarily to detect any differences between high and low PDI groups.

To summarize, in the present experiment, the idea that those high in delusional ideation display liberal acceptance when reasoning about delusional and neutral content was again tested. It was also an aim of the experiment to investigate the relationship between delusional thinking, creativity and apophenia.

It was expected that high PDI scorers would rate narratives as more likely to be true and more exciting than low PDI scorers. A multiple linear regression was also employed to test the prediction that PDI scores would be significantly predicted by the Novelty sub-scale of the Emotional Creativity Inventory and the Remote Associate Test. Consistent with previous research it was also expected that high PDI scorers would display more cognitive 'looseness' and detect more pictures in the snowy images where no picture has been embedded in the Snowy Pictures Task (Ekstrom et al., 1976).

Method

Participants

Ninety-six participants took part (84 female) with a mean age of 20.78 (SD = 3.91). Participants were recruited voluntarily from a large urban UK university and received course credits for their participation.

Materials

Once informed consent was complete (Appendix 16 & 17), participants completed the following measures.

Delusional Ideation. The Peters et al. Delusions Inventory, (Peters et al., 1996; Appendix 4) was again employed to place individuals into high and low scoring groups.

Narratives. The narratives were made shorter for this study to reduce participant fatigue (see examples below). Additionally, bizarre delusions were not included since previous findings indicated that the content may have been too bizarre when utilised in a subclinical sample. Four delusional narratives were used based on four types of delusion: grandiose delusions, persecutory delusions, delusions of reference and

Schneiderian delusions (thought insertion/ thought broadcasting; Appendix 18). Delusional narratives were developed from first person accounts in special issues of *Schizophrenia Bulletin* (Chapman, 2002; Herrig, 1995; Payne, 1992; Weiner, 2003; Zelt, 1981). For example, the grandiose narrative read:

While working, Reece began to feel that he had such enormous insight into subject areas he hadn't previously studied. He began to think of himself as being somewhat special and having a special mind to be thinking these things. He thought he was 'chosen'.

Three neutral narratives were also constructed for this study (Appendix 19). An example of a neutral narrative is:

Karen owned a lot of modern art. Since moving to a smaller house she had found it hard to find a place for everything and considered whether she should sell or use a storage facility for some of her art to make more space.

Participants were asked to read each narrative and give ratings on a five-point scale of how likely they think the narrative is true, as well as how exciting they find the narrative and how exciting the narrative would be to most other people with 1 being 0%, 3 being 50% and 5 being 100%.

The Novelty sub-scale of the Emotional Creativity Inventory (Averill, 1999; Appendix 12) and the Remote Associate Test (RAT; Mednick, 1962; Appendix 13) was completed. Participants also completed the Eysenck Lie Scale (Eysenck & Eysenck, 1976; Appendix 7), identical to Chapter 3.

Cognitive 'Looseness' – Snowy Pictures Task (Ekstrom, French, Harman, & Dermen, 1976; Appendix 20*).* This task involves viewing 24 images. Twelve of the images contain objects embedded in 'noise' while 12 of the images contain no objects. Participants are asked to indicate if they can see an object and what it is they can see in the images. This is illustrated in Figure 4 along with standardised instructions.

It is helpful to be able to see objects quickly in spite of their being partially concealed by snow, rain, haze, darkness, or other visual obstructions.

Look at the picture below. What object do you see?

Sample Item 1:

By looking carefully at this sample you will see an anchor.

Some pictures in this test may have no object in them. If you believe a picture does not have an object in it then describe the picture by writing 'none'.

Your score on this test will be the number of objects that you name correctly. Work as quickly as you can without sacrificing accuracy. If some pictures are difficult, skip them and return to them later if you have time.

Do not spend too much time on any one picture.

Figure 4. *Illustration of the Snowy Pictures Task and standardized instructions*

Design

A mixed design was employed with PDI group (high/ low) being the between-groups factor and Narratives (delusional/ neutral) and Perspective (self/ other) as within-group factors. The dependent variables were: likelihood of being true, exciting to the self and exciting to others.

Additional dependent variables were the scores on the measures of creativity; the Emotional Creativity Inventory and the Remote Associate Test.

The final dependant variables were the number of objects correctly identified in the Snowy Pictures Task, the number of objects incorrectly identified, the number of objects incorrectly detected (i.e. indicated there was an object when no object had been embedded; i.e. a false positive), and finally the participant stating that there was no object (i.e. that there was no object embedded in the image) and this was correct.

Procedure

Participants completed the study via an online platform. Participants were presented with information regarding the study and consent was gained by checking a number of statements. Questions were presented in a fixed order. Participants firstly assigned ratings to the delusional and neutral narratives. These were ordered by presenting a delusional narrative followed by a neutral narrative and this sequence was fixed for all seven narratives. Participants then completed the Eysenck Lie Scale (Eysenck & Eysenck, 1976). The Remote Associate Test (Mednick, 1962) was presented next to act as an interval between rating scales. Participants then went on to complete the Novelty subscale of the Emotional Creativity Inventory (Averill, 1999) and the Peters et al. Delusions Inventory (Peters et al., 1996). The Snowy Pictures Task (Ekstrom et al., 1976) measuring cognitive looseness was presented last. A debrief page was displayed to participants on completion of the study thanking them for participation and detailing the researcher's contact details.

Results

Total PDI scores were used to divide participants into high and low scoring groups. A median split was conducted and those scoring up to and including the median of 47 made the low PDI group, while those scoring over the median made the high PDI group. There were 47 participants in the low PDI group and 46 participants in the high PDI group. Independent t-tests revealed a significant difference between males and females and PDI score ($t\,(91) = 3.55$; $p < 0.01$) with males having higher PDI scores than females. There was also a significant PDI group difference in age ($t\,(91) = -2.53$; $p < 0.05$). High PDI scorers had a higher mean age than low PDI scorers. There were no significant PDI group differences on the Lie Scale ($t\,(90) = 0.659$; $p = 0.51$). Summary statistics are displayed in Table 4.1.

Table 4.1

Summary statistics for high and low PDI groups

	High PDI Group *(n)*	Low PDI Group *(n)*	PDI *Mean (S.D.)*
Female	36	42	50.17 (35.47)
Male	10	2	90.75 (46.33)
	Mean (S.D.)	*Mean (S.D.)*	-
Age	21.85 (5.3)	19.81 (1.39)	-
PDI Score	86.80 (30.57)	24.68 (14.53)	-
Lie scale	5.5 (3.64)	6 (3.63)	

A two-way ANOVA was conducted with PDI group as the between groups variable and the narratives (delusional/ neutral) as the within-group variable and the participants' likelihood ratings as the dependent variable. The data did not approximate a normal distribution (see Appendix 36) however it has been demonstrated that ANOVA is robust to moderate deviations from normality (Kim, 2013). Homogeneity of variance was met for the comparison on neutral narratives ($p = .5$) however it was not met for delusional narratives ($p < .05$).

This analysis examined average ratings of how likely the narrative was true between high and low PDI groups. There was no main effect of PDI group ($F(1, 91) = 0.011$; $p = 0.92$; $\eta p^2 = 0.00$). There was a significant main effect of narrative ($F(1, 91) = 152.695$; $p < 0.01$; $\eta p^2 = 0.627$). Neutral narratives had higher ratings than delusional narratives. The interaction was significant ($F(1, 91) = 6.259$; $p = 0.01$; $\eta p^2 = 0.06$). As can be seen from Table 4.2, this appears to be from a crossover effect. While the high PDI group rate higher on delusional narratives and lower on neutral narratives, the low PDI group rate higher on neutral narratives and lower on delusional narratives.

Table 4.2

Mean values (standard deviation in parenthesis) for how likely the delusional and neutral narratives were true between high and low PDI groups

	Delusional narrative	Neutral narrative	Overall
High PDI group	2.25 (0.90)	3.27 (0.90)	2.76 (0.90)
Low PDI group	2.01 (0.54)	3.54 (0.84)	2.77 (0.69)
Overall	2.13 (0.72)	3.40 (0.87)	2.76 (0.79)

Follow up analyses (independent *t*-tests) to explore the significant interaction between high and low delusional ideation groups and average ratings of how likely the narrative was true were carried out.

The difference between the high and low PDI groups was not significant when rating delusional narratives (t (91) = 1.59; p = .18). Neither was the difference significant between the high and low PDI groups when rating neutral narratives (t (91) = 1.51; p = .14).

A three-way ANOVA was conducted with PDI Group (high/ low) as the between groups variable and Content (delusional/ neutral) and Perspective (self/ other referent) as the within group variables and average ratings of excitement of the delusional and neutral narratives as dependent variables. Homogeneity of variance was met for all comparisons (p > .05).

There was no main effect of PDI group (F(1, 91) = 1.016; p = 0.32; ηp^2 = 0.01). There was a main effect of Content (F(1, 91) = 45.586; p < 0.01; ηp^2 = 0.334). As can be seen from Table 4.3, delusional narratives were rated as more exciting than neutral narratives. The main effect of Perspective was significant (F(1, 91) = 9.562; p < 0.01; ηp^2 = 0.095) with narratives being rated as more exciting to others than to the self. None of the interactions were significant for this analysis (p > 0.45).

Table 4.3.

Mean values (standard deviations in parenthesis) for how exciting delusional and neutral narratives were rated to be to the self or to most other people between high and low PDI groups

	High PDI	Low PDI	Overall
Delusional/ Self-Referent	2.20 (0.70)	2.06 (0.67)	2.13 (0.68)
Delusional/ Other-Referent	2.36 (0.98)	2.23 (0.59)	2.29 (0.78)
Neutral/ Self-Referent	1.69 (0.71)	1.61 (0.76)	1.65 (0.73)
Neutral/ Other-Referent	1.82 (0.78)	1.67 (0.72)	1.74 (0.75)
Overall	2.02 (0.79)	1.89 (0.68)	1.95 (0.73)

A multiple linear regression incorporated the Remote Associates Test and the Emotional Creativity Inventory as predictors of PDI scores. The Durbin Watson value was 1.69. The model was statistically significant ($F(2, 90) = 19.533$; $p < 0.01$; $R^2 = 0.30$) explaining 30% of the variation in PDI scores. Emotional creativity made a significant contribution towards the model (*Beta* = 0.55; $p < 0.01$) but the Remote Associate Test was non-significant. Mean scores, Beta values, *t* values, *p* values and partial correlations can be found in Table 4.4.

Table 4.4

Mean scores (standard deviation in parenthesis), Beta values, t values, p values, partial correlations and VIF for the Emotional Creativity Inventory and the Remote Associates Test

	Means (SD)	Beta	*t* value	*p* value	Partial correlations	VIF
Emotional Creativity	42.05 (12.69)	0.55	6.226	< 0.001	0.55	1
Remote Associates Test	2.14 (2.16)	- 0.07	- 0.842	0.40	- 0.09	1

The Snowy Pictures Task was split into four categories; the number of objects that were correctly identified, the number of objects incorrectly identified, the number of objects incorrectly detected (i.e. indicated there was an object that was not there; a false positive), and finally the participant correctly indicating that there was no object embedded. Exploratory data analysis indicated that the data was not normally distributed ($p < .05$; see Appendix 36 for exploratory analysis and equivalent non-parametric tests). Homogeneity of variance was met for all comparisons except for the number of objects incorrectly identified (p = .04) therefore this result should be interpreted with caution.

One way ANOVAs revealed a significant difference between high and low PDI groups for the number of objects incorrectly detected (false positives) ($F(1, 91) = 4.69$; $p = 0.03$). As can be seen in Table 4.5, the high PDI group incorrectly detected more objects than the low PDI group when no object had been embedded. The number of objects incorrectly identified was also found to be approaching significance ($F(1, 91) = 3.32$; $p = 0.07$) with high PDI scorers incorrectly identifying more objects than low PDI scorers. However, the difference between the high and the low PDI groups was not significant for the number of objects that were correctly identified ($F(1, 91) = 0.229$; $p = 0.63$) or when the participant correctly indicated that there was no object embedded ($F(1, 91) = 0.295$; $p = 0.59$).

Table 4.5

Mean values (standard deviations in parenthesis) for the Snowy Pictures Task between high and low PDI groups

	High PDI	Low PDI	Overall
Objects correctly identified	7.24 (2.09)	6.98 (3.05)	7.11 (2.57)
Objects incorrectly identified	4.80 (2.2)	3.91 (2.5)	4.35 (2.35)
Objects incorrectly detected	3.74 (2.64)	2.66 (2.14)	3.2 (2.39)
No objects indicated - correct	8.22 (2.68)	7.87 (3.40)	8.04 (3.04)
Overall	6 (2.4)	5.35 (2.77)	5.67 (2.59)

Discussion

The prediction that high PDI scorers would rate narratives more highly than low PDI scorers was only partially supported. The significant two-way interaction between PDI group and narratives resulted in a crossover effect whereby the high PDI group gave significantly higher ratings on delusional narratives, while the low PDI group gave significantly higher ratings on neutral narratives. This is consistent with the findings of LaRocco and Warman (2009) as they found that those high in delusional ideation rated delusional narratives as more likely to be true compared to those low in delusional ideation. In the present study however, those low in delusional ideation displayed the opposite effect, rating neutral scenarios as more likely to be true. This finding appears to differ to that of LaRocco and Warman (2009) as both groups in their study assigned equivalent probability estimates to neutral stimuli. Nonetheless, consistent with Chapter 3, both groups rated narratives as more likely/ true but high PDI scorers still rated more highly than low PDI scorers across both types of narrative supporting a liberal acceptance account (Moritz & Woodward, 2004; Moritz et al., 2006; Moritz et al., 2008; Moritz et al., 2007).

Additionally, the high PDI group rated delusional narratives as more exciting compared to the low PDI group but this effect did not achieve significance. Nonetheless, this is consistent with Chapter 2 and with authors who have theorised that those who hold divergent beliefs may seek excitement, as a preference to a more rational view of the world (Kumar et al., 1993). As seen in Chapter 3, this does not necessarily imply that those high in delusional ideation are sensation seekers (Zuckerman, 1994) but that delusional stimuli affect reasoning in a unique way (LaRocco & Warman, 2009) and thus, excitement about implausible material may lead to this being accepted more easily.

The prediction that creativity would be significantly associated with and predict PDI scores was only partially supported. The Emotional Creativity Inventory was positively associated and significantly predicted PDI scores. While the Remotes Associate Test did not significantly predict PDI scores, the relationship was seen to be a negative one, suggesting that low PDI scorers did better than high PDI scorers. This is in line with earlier suggestions that low PDI scorers perform better on convergent thinking tasks and high PDI scorers tend to demonstrate a 'looser' cognitive style and therefore may not perform as well when the task is to narrow the options down to a single answer (cf. Young & Bentall, 1995). However, the association between PDI scores and emotional creativity was positive and significant, supporting this prediction. As suggested by Averill (1999), an emotionally creative response can be considered novel in comparison to an individual's usual behaviour or novel in comparison to the typical behaviour in a society. Indeed, it has been posited that one of the key aspects of emotional creativity is the ability to think in novel ways, particularly in comparison to group norms (Averill, 1999; Humphreys, et al., 2008). Averill (1999) found that those who score highly on the General Mysticism Scale (Hood, 1975) measuring unusual experiences had greater emotional creativity - this also appears to extend to those who hold unusual beliefs in the current study. Furthermore, emotional creativity has previously been shown to be positively associated with fantasy proneness (Fuchs et al., 2007).

Although it appears evident that creativity is associated with schizotypy (e.g. Nettle, 2006), it could be argued that this is only with reference to specific types of creativity. For example, findings imply that those low in delusional ideation perform better on convergent thinking tasks (such as the Remote Associates Test) perhaps due to greater cognitive inhibition (Davidson-Jenkins, 2003). Conversely, this would imply that those high in delusional ideation would therefore display greater cognitive 'looseness' or disinhibition.

In the present study, the prediction that those high in delusional ideation would report more objects on the Snowy Pictures Task when no object had been embedded was supported. High PDI scorers, compared to low PDI scorers, detected more objects that were not there in visual 'noise' and the number of objects incorrectly identified was also approaching significance, indicating a 'loose' or disinhibited cognitive style. This is not only consistent with a lowered threshold of acceptance (Moritz & Woodward, 2004) but also with previous research that has demonstrated that schizotypy is associated with people finding complex types of visual patterns such as, static or moving people and objects in visual displays of random dots (Farias et al., 2005). Consistent with this, Brugger and colleagues (1993) demonstrated that those high on the Magical Ideation Scale were able to see more meaningful patterns in a visual display of random dots. This has led authors to argue that this leads the individual to make close associations between random events, which in turn may account for the emergence of magical and paranormal, as well as delusional beliefs (Farias et al., 2005).

In terms of the formation of delusional beliefs, the findings from the present experiment are consistent, suggesting that 'likelihood of being true' and 'excitement' continue to be important variables and may explain why scenarios are deemed plausible and are thus accepted. Furthermore, those higher in delusional ideation display greater emotional creativity (Averill, 1999) and detect more pictures embedded in visual 'noise' when no picture has been embedded compared to those low in delusional ideation, indicating a 'looser' or disinhibited cognitive style. Taken together, these findings offer new insight into liberal acceptance (Moritz & Woodward, 2004) in a subclinical sample where those with a lower threshold of acceptance, such as those high in delusional ideation in the current sample, liberally accept, perhaps because of the tendency to perceive meaningful patterns or make causal connections where there are none to be found (Fyfe et al., 2008).

This was explored further in Chapter 5. While Chapter 4 examined the tendency to perceive meaningful patterns/ causal connections where none exist or apophenia in a perceptual manner, Chapter 5 aimed to examine apophenia in a non-perceptual manner by utilizing an associative processing task and a measure of coincidental experiences. Liberal acceptance was again explored by examining 'likelihood' and 'excitement' of narratives.

Chapter V

Creativity and non-perceptual apophenia as factors in delusional thinking and reasoning

> *'Every single thing 'means' something. This kind of symbolic thinking is exhaustive… I have a sense that everything is more vivid and important; the incoming stimuli are almost more than I can bear. There is a connection to everything that happens—no coincidences. I feel tremendously creative.'*
>
> (Brundage, 1983; p. 584)

Introduction

In Chapter 4, it was found that high PDI scorers detected objects in visual 'noise' on the Snowy Pictures Task when no objects were embedded, demonstrating a 'loose' cognitive style which may be indicative of less rigid associative processing (Rominger, Weiss, Fink, Schulter & Papousek, 2011). The aim of Chapter 5 was to examine creativity and apophenia using non-perceptual information in the form of an associative processing task and coincidental experiences.

At one time or another, everyone will have experienced something coincidental. For example, perhaps someone thinks of a friend who they have not heard from or met with in a long time. The person decides to telephone the friend but at the exact moment they decide to call, the person receives a phone call from the very same friend they were just about to call. The connection between these two events (the intention to call the friend and the call from the same person) are perceived as meaningful – too surprising to be chance alone. Some authors have put forward that making these kinds of causal connections between random, coincidental events can account for the emergence of superstitious behaviour and paranormal beliefs which in turn, only serves to reinforce coincidences as meaningful (Bressan, 2002; Brugger et al., 1990; Fiedler, 2004). Indeed, coincidences may be responsible for the formation of such beliefs because these seemingly objective connections seem unexplained by reason and science (Bressan, 2002). Eysenck (1994) has referred to this type of cognitive looseness as 'allusive thinking'; a cognitive style that is related to and links both psychosis and creativity. Studies have supported this theory by finding similarities between schizotypy and creativity: in particular unusual experiences and impulsive nonconformity share a positive relationship with creativity, however cognitive disorganisation (characterised by disorganised thoughts) has been shown to be negatively related to creativity (Batey & Furnham, 2008).

Furthermore, creativity as assessed by divergent thinking scores has been predicted by positive schizotypy (Green & Williams, 1999; O'Reilly, Dunbar & Bentall, 2001). Giannotti, Mohr, Pizzagalli, Lehmann and Brugger (2001) place this associative type of processing on a continuum from creative, to paranormal, to disordered thought. Giannotti et al. (2001) found that believers in the paranormal made more unique associations between word pairs that were unrelated demonstrating that believers in the paranormal may employ a looser cognitive style in comparison to sceptics who produced less unique associations to unrelated word pairs.

The ability to make new associations between events can be seen as useful and even crucial to the creative process (Gianotti, et al., 2001) and can be viewed as the most basic element required for learning (Rominger et al., 2011). One particular task known as the Bridge-the-Associative-Gap task (BAG; Gianotti, et al., 2001) not only measures creativity, but also a cognitive ability Gianotti et al. (2001) term as 'associative processing'. In terms of delusional thinking, the ability to 'bridge' associative gaps can mean displaying the tendency to make meaningful associations between random events or what is termed apophenia (Fyfe et al., 2008).

Indeed, Bressan (2002) also supports this position with the finding that paranormal believers report experiencing a higher frequency of coincidences. While some authors have attributed this to individuals underestimating the probability of such coincidences occurring by chance (Blackmore & Troscianko, 1985), the findings of Bressan (2002) suggest an alternative explanation - that believers in the paranormal make more causal connections based on less evidence. As a consequence of this, individuals experience a greater number of meaningful coincidences. This is consistent with literature demonstrating reasoning biases in delusional and delusion prone populations whereby fewer data are gathered (see Fine et al., 2007) before making a decision, thus leading to the formation of poorly supported and aberrant beliefs.

In line with Chapter 2, 3 and 4, narratives containing delusional and neutral content were utilized to assess a liberal reasoning style. Participants were again asked to rate narratives on 'likelihood of being true', 'exciting to self' and 'exciting to others' as these appear to be important factors for the liberal acceptance account (Moritz & Woodward, 2004). The Bridge the Associate Gap task (Gianotti et al., 2001) was also employed as a measure of creativity/ 'associative processing' and the Coincidences Questionnaire (Bressan, 2002) as a measure of non-perceptual apophenia to examine if those high in delusional ideation make more causal connections where none exist.

In light of previous research/findings, it was expected that the high PDI group would rate delusional narratives as more likely to be true and more exciting than the low PDI group. It was also predicted that the high PDI group would generate more associative words compared to the low PDI group on the Bridge the Associate Gap task. Finally, it was expected that the high PDI group would report experiencing more coincidences compared to the low PDI group as well as endorse alternatives to 'pure chance' when considering what coincidences are due to.

Method

Participants

One-hundred-twenty-one participants took part (105 female) with a mean age of 21.26 (S.D. = 5.24). Participants were recruited voluntarily from a large urban UK university and received course credits for their participation.

Materials

Once informed consent was complete (Appendix 21 & 22), the Peters et al. Delusions Inventory (Peters, et al., 1996; Appendix 4) was again employed as a measure of delusional ideation. Additionally, participants assessed a series of delusional and neutral narratives (Appendix 18 & 19) and completed the Remote Associate Test (Appendix 13), identical to Chapter 4.

Bridge-the-Associate-Gap Task

The Bridge-the-Associate-Gap Task (Gianotti et al., 2001; Appendix 23) involves viewing a pair of either semantically indirectly related word pairs (e.g. flower – nose) or semantically unrelated word pairs (e.g. people - piece) and generating an associative word.

Coincidence Questionnaire

This questionnaire consists of 15 items divided into three sections. The first section measures how often participants have come across meaningful coincidences. The second section measures coincidences in various categories. For example, one question asks how often they have experienced spontaneous associations (like thinking of someone and running unexpectedly into that person soon afterwards), while another question asks how often they have experienced the perception of something distant in time (like having a dream that then comes true). Items are rated from 1 to 5 with 1 being 'never' and 5 being 'very often'. The final section asks what participants think coincidences are due to with options such as 'pure chance' and 'destiny'. Participants indicate either 'Yes', 'No' or 'Don't Know' (Bressan, 2002; Appendix 24).

Design

A mixed design was employed with PDI group (high/ low) being the between-groups factor and Narratives (delusional/ neutral) and Perspective (self/ other) as within-group factors. The dependent variables were: likelihood of being true, exciting to the self and exciting to others. The other dependent variables were the associative words generated on the Bridge the Associate Gap task and responses to the Coincidences questionnaire.

Procedure

All measures were completed via an online survey platform. After informed consent was gained participants completed the Bridge the Associate Gap task (Gianotti et al., 2001), the Coincidences questionnaire (Bressan, 2002) and then assigned ratings to the delusional and neutral narratives. These were counterbalanced by presenting a delusional narrative followed by a neutral narrative and this sequence was fixed for all seven narratives. Participants then went on to complete the Peters et al. Delusions Inventory (Peters et al., 1996). After completion, participants viewed a debrief page thanking them for participation and specifying the researcher’s contact details.

Results

Total PDI scores were used to divide participants into high and low scoring groups. A median split was conducted and those scoring up to and including the median of 46 made the low PDI group, while those scoring over the median made the high PDI group. There were 63 participants in the low PDI group and 58 participants in the high PDI group. Independent t-tests revealed no significant difference between males and females and PDI score (t (119) = -1.86; p = 0.07) nor any PDI group differences in age (t (119) = 0.6; p = 0.55). Summary statistics are displayed in Table 5.1.

Table 5.1

Summary statistics for high and low PDI groups

	High PDI Group *(n)*	Low PDI Group *(n)*	PDI *Mean (S.D.)*
Female	55	50	57.13 (38.95)
Male	3	13	38.19 (30.66)
	Mean (S.D.)	*Mean (S.D.)*	-
Age	20.97 (5.38)	21.54 (5.14)	-
PDI Score	85.96 (31.23)	25.78 (13.86)	-

Narratives

A two-way ANOVA was conducted with PDI group (high/ low) as the between groups variable and the narratives (delusional/ neutral) as the within-group variable and the participants likelihood ratings as the dependent variable. The data approximated a normal distribution (p = .2; see Appendix 36). A Levene's test found that homogeneity of variance had been met for neutral narratives (p = .71) but had not been met for delusional narratives (p = .05) hence interpretation of the results should remain cautious.

This analysis examined average ratings of how likely the narrative was true between high and low PDI groups. There was a main effect of PDI group (F (1, 116) = 4.80; p = 0.03; ηp^2 = 0.04) with the high PDI group having higher scores than the low PDI group. There was also a main effect of narrative (F (1, 116) = 332.227; p <0.001; ηp^2 = 0.741). Neutral narratives had higher ratings than delusional narratives. The interaction was not significant (F (1, 116) = 0.130; p = 0.719; ηp^2 = 0.001). As can be seen from Table 5.2, the high and the low PDI groups both rate neutral narratives more highly than delusional narratives.

Table 5.2

Mean values (standard deviation in parenthesis) for how likely the delusional and neutral narratives were true between high and low PDI groups.

	Delusional narrative	Neutral narrative	Overall
High PDI group	2.21 (0.69)	3.75 (0.73)	2.98 (0.71)
Low PDI group	1.95 (0.68)	3.55 (0.85)	2.75 (0.76)
Overall	2.08 (0.68)	3.65 (0.79)	2.86 (0.73)

A three-way ANOVA was conducted with PDI Group (high/ low) as the between groups variable and Content (delusional/ neutral) and Perspective (self/ other referent) as the within group variables and average ratings of excitement of the delusional and neutral narratives as dependent variable. Homogeneity of variance was met for all comparisons ($p > .05$) except for ratings of excitement to oneself for neutral narratives ($p < .05$).

There was a main effect of PDI group (F (1, 114) = 5.026; p = 0.03; ηp^2 = 0.04) with the high PDI group having higher ratings than the low PDI group. Additionally, there was a main effect of Content (F (1, 114) = 67.484; p <0.001; ηp^2 = 0.372). Delusional narratives were rated as more exciting than neutral narratives. The main effect of Perspective was significant (F (1, 114) = 18.025; p = 0.001; ηp^2 = 0.137) with narratives being rated as more exciting to others than to the self. The interaction between PDI group and Perspective was approaching significance (F (1, 114) = 3.3; p = 0.07; ηp^2 = 0.028). As shown in Table 5.3, the ratings differed more between self and other perspectives for the low PDI group than the high PDI group.

Table 5.3

Mean values (standard deviations in parenthesis) for how exciting delusional and neutral narratives were rated to be to the self or to most other people between high and low PDI groups

	High PDI	Low PDI	Overall
Delusional/ Self-Referent	2.23 (0.69)	1.94 (0.69)	2.08 (0.69)
Delusional/ Other-Referent	2.35 (0.63)	2.26 (0.58)	2.30 (0.60)
Neutral/ Self-Referent	1.66 (0.74)	1.39 (0.54)	1.52 (0.64)
Neutral/ Other-Referent	1.78 (0.68)	1.69 (0.62)	1.73 (0.65)
Overall	2.01 (0.68)	1.82 (0.61)	1.91 (0.64)

Bridge the Associate Gap Task

A further three-way ANOVA was used to examine responses on the Bridge the Associate Gap task with PDI group (high/ low) as the between groups factor and stimulus type (indirectly related/ unrelated) and association category (unique/ rare/ common) as within group factors. The number of associative words generated was the dependent variable. The number of associated words in each category did not approximate a normal distribution ($p < .05$) but this was expected given the nature of the task (see Appendix 36) and it has been demonstrated that ANOVA is robust to moderate these deviations from normality (Kim, 2013). Homogeneity of variance was met for all comparisons ($p > .05$).

There was no main effect of PDI group (F (1, 119) = 0.321; p = 0.57; ηp^2 = 0.003). There was a main effect of stimulus type (F (1, 119) = 6.302; p = 0.01; ηp^2 = 0.05) with indirectly related word pairs generating more associative words than the unrelated word pairs. The main effect of association category was also significant (F (1, 119) = 444.546; p < 0.001; ηp^2 = 0.789). More common words were generated followed by unique words and finally rare words. Simple contrasts revealed a significant difference between all categories (p < .01). There was a significant interaction between stimulus type and association category (F (1, 119) = 37.494; p < 0.001; ηp^2 = 0.240). More common words were generated for both indirectly related and unrelated word pairs however the difference is larger for unique words between unrelated word pairs and indirectly related word pairs (See Table 5.4). No other interactions were significant for this analysis ($p \geq$ 0.77).

Table 5.4

Mean values (standard deviations in parenthesis) for unique, rare and common words generated for indirectly related and unrelated words pairs between high and low PDI groups

	High PDI	Low PDI	Overall
Indirectly Related/ Unique	1.33 (1.59)	1.52 (1.43)	1.42 (1.51)
Indirectly Related/ Rare	1.17 (1.27)	1.03 (1.03)	1.1 (1.15)
Indirectly Related/ Common	7.38 (1.76)	7.43 (1.77)	7.4 (1.76)
Unrelated/ Unique	2.48 (1.89)	2.63 (1.92)	2.55 (1.9)
Unrelated/ Rare	1.15 (1.24)	1.19 (1.09)	1.17 (1.16)
Unrelated/ Common	6.05 (1.89)	5.92 (2.02)	5.98 (1.95)
Overall	3.26 (1.61)	3.29 (1.54)	3.27 (1.57)

Follow up analyses (paired samples *t*-tests) explored the significant interaction between stimulus type and association categories. A Bonferroni correction was employed due to three comparisons being made. The *p* value needed to be less than .017 to achieve statistical significance.

The first analysis examined stimulus type (indirectly related and unrelated words) and the number of unique words generated. The difference between the indirectly related and unrelated word categories was significant (t (83) = -6.56; p <.01). More unique words were generated in the unrelated word category (M = 3.08; SD = 2.1) compared to unique words generated in the indirectly related word category (M = 1.64; SD = 1.66).

The second analysis examined stimulus type (indirectly related and unrelated words) and the number of rare words generated. The difference between the indirectly related and unrelated word categories was not significant (t (83) = 1.36; p = .18). More rare words were generated in the indirectly related word category (M = 1.38; SD = 1.21) compared to rare words generated in the unrelated word category (M = 1.15; SD = 1).

The final analysis examined stimulus type (indirectly related and unrelated words) and the number of common words generated. The difference between the indirectly related and unrelated word categories was significant (t (83) = 5.96; p <.01). More common words were generated in the indirectly related word category (M = 6.89; SD = 1.85) compared to common words generated in the unrelated word category (M = 5.45; SD = 2.12).

Coincidences

An Independent samples t-test was used to examine the difference between high and low PDI groups and the total number of coincidences reported. Exploratory data analysis indicated that the data was not normally distributed (p < .05; see Appendix 36 for exploratory analysis and equivalent non-parametric tests). Homogeneity of variance was met (p > .05). Results revealed a significant difference between high and low PDI groups (t (119) = -02.02; p = 0.05) with the high PDI groups mean score being 22.41 (SD = 4.85) and low PDI groups mean score being 20.36 (SD = 6.18).

Data were further analysed using Spearman's correlation to examine if there was any relationship between total PDI score and categories of coincidences. Significant positive correlations were found between total PDI score and General Coincidences (r (119) = 0.223; p = 0.01), Clusters of Events (r = (119); 0.228; p = 0.01), Spontaneous Associations (r (119) = 0.324; p <0.001), Perceptions Distant in Space (r = (117); 0.255; p = 0.005), Perceptions Distant in Time (r (119) = 0.271; p = 0.003) and Guardian Angel Experiences (r (119) = 0.375; p < 0.001). Unexpected solutions (r (121) = 0.105; p = 0.252) and Small World Experiences (r (120) = 0.141; p = 0.125) did not correlate significantly with PDI score.

A multiple linear regression analysis incorporating the variables: Guardian Angel Experiences, General Coincidences, Perceptions Distant in Time, Perceptions Distant in Space, Small World Experiences, Clusters of Events, Spontaneous Associations and Unexpected Solutions (Durbin Watson = 1.81) significantly predicted PDI score (F (1, 117) = 3.405; p = 0.002; R^2 = 0.20) with 20% of the variance in PDI scores being explained by the model. As can be seen from Table 5.5, Spontaneous Associations, Unexpected Solutions and Guardian Angel Experiences made a significant contribution to the model.

Table 5.5

Mean (standard deviation in parenthesis), Beta, t values, p-values, partial correlations and VIF for Guardian Angel Experiences, General Coincidences, Perceptions Distant in Time, Perceptions Distant in Space, Small World Experiences, Clusters of Events, Spontaneous Associations and Unexpected Solutions.

Variable	Mean (S.D.)	Beta	*t* value	*p* value	Partial correlations	VIF
Guardian Angel Experiences	2.59 (1.23)	0.268	2.503	0.01	0.233	1.71
General Coincidences	3.09 (0.88)	0.039	0.402	0.69	0.038	1.4
Perceptions Distant in Time	2.52 (1.23)	0.121	1.144	0.25	0.109	1.9
Perceptions Distant in Space	2.12 (1.07)	0.086	0.756	0.45	0.072	2.21
Small World Experiences	2.84 (0.93)	- 0.067	-0.637	0.52	-0.061	1.48
Clusters of Events	2.88 (1.03)	0.057	0.557	0.58	0.053	1.41
Spontaneous Associations	3.07 (1.01)	0.240	2.26	0.03	0.211	1.71
Unexpected Solutions	2.29 (1.08)	- 0.253	-2.231	0.03	-0.209	1.92

It was found however that whilst unexpected solutions and small world experiences shared a non-significant positive correlation with PDI score, these shared a negative association in the regression model (significantly so for unexpected solutions). This was investigated further in a series of regression models to explore the possibility of suppressor variables.

When Unexpected Solutions and Small World Experiences were removed (Durbin Watson = 2.07) the model remained significant (F (6, 112) = 4.18; p = 0.001; R^2 = 0.18) and accounted for 18% of the variance in PDI scores. Spontaneous Associations (*Beta* = 0.204; p = 0.05) and Guardian Angel Experiences (*Beta* = 0.23; p = 0.03) made significant contributions to the model (see Table 5.6).

Table 5.6

Beta, t- values, p-values, partial correlations and VIF for Guardian Angel Experiences, General Coincidences, Perceptions Distant in Time, Perceptions Distant in Space, Clusters of Events and Spontaneous Associations.

Variable	*Beta*	*t* value	*p* value	Partial correlations	VIF
Guardian Angel Experiences	0.230	2.188	0.03	0.203	1.59
General Coincidences	0.062	0.636	0.53	0.06	1.44
Perceptions Distant in Time	0.033	0.323	0.75	0.031	1.77
Perceptions Distant in Space	0.012	0.109	0.91	0.01	2.12
Clusters of Events	0.033	0.321	0.75	0.03	1.35
Spontaneous Associations	0.204	2.004	0.05	0.186	1.58

The strongest model emerged when all previous predictor variables were included except for small world experiences (Durbin Watson = 2.05). The model accounted for 22% of the variance in PDI scores (F (7,111) = 4.37; p < 0.001; R^2 = 0.22) and as can be seen in Table 5.7, Guardian Angel Experiences, Spontaneous Associations and Unexpected Solutions made a significant contribution towards the model. Unexpected Solutions maintains a negative beta value (despite a positive, non-significant bivariate correlation) and is a significant contributor to the regression model suggesting that this variable is suppressing irrelevant variance in other predictor variables resulting in a stronger model overall when included (see Pandey & Elliott, 2010).

Table 5.7

Beta, t- values, p-values, partial correlations and VIF for Guardian Angel Experiences, General Coincidences, Perceptions Distant in Time, Perceptions Distant in Space, Clusters of Events, Spontaneous Associations and Unexpected Solutions.

Variable	*Beta*	*t* value	*p* value	Partial correlations	VIF
Guardian Angel Experiences	0.283	2.668	0.009	0.245	1.74
General Coincidences	0.058	0.601	0.55	0.057	1.44
Perceptions Distant in Time	0.085	0.833	0.41	0.079	1.81
Perceptions Distant in Space	0.067	0.597	0.55	0.057	2.21
Clusters of Events	0.066	0.649	0.59	0.062	1.48
Spontaneous Associations	0.228	2.266	0.02	0.210	1.59
Unexpected Solutions	- 0.239	-2.163	0.03	-0.201	1.96

Finally, two-way Chi-Square tests were used to investigate if there were any associations between PDI group and what participants thought coincidences were due to. There was a significant association between PDI group and Pure Chance (χ^2 (df = 2) = 9.967; p = 0.03), Destiny (χ^2 (df = 2) =16.718; p < 0.001), Divine Intervention (χ^2 (df = 2) = 9.832; p = 0.007) and Everything Being Connected to Everything Else in the Universe (χ^2 (df = 2) = 9.034; p = 0.01). It appears that those in the low PDI group attribute coincidences to Pure Chance; while those in the high PDI group appear to attribute coincidences to Destiny, Divine Intervention and Everything being Connected to Everything Else in the Universe. No significant associations were found between PDI group and Extra-Sensory Perception, Intuition or Physical Principles Not Yet Discovered by Science ($p \geq 0.06$).

Discussion

High PDI scorers gave significantly higher ratings of 'how likely to be true' for narratives containing delusional and neutral content. Both groups rated neutral narratives as more likely/ true but high PDI scorers still gave higher ratings to both scenarios in comparison to low PDI scorers. While this partially supports the work of LaRocco and Warman, (2009), it is argued that this finding adds further evidence of a liberal acceptance bias in delusion prone individuals for scenarios in general; where those with a lower threshold of acceptance liberally accept information that others would reject or rate lowly (Moritz & Woodward, 2004). In addition, when asked how exciting participants found the narratives, high PDI scorers gave higher ratings than low PDI scorers. Excitement may explain why high PDI scorers accept scenarios more easily, especially delusional ones, since they offer an alternative to a rational view of the world (Kumar et al., 1993). In addition, further analysis revealed that, compared to low PDI scorers, high PDI scorers rate delusional narratives as significantly more exciting to the self than neutral narratives – an effect not demonstrated when high and low PDI scorers were compared on how exciting delusional and neutral narratives would be to others. This is consistent with previous theory and research suggesting a self-reference bias in the prodromal stages of schizophrenia (Sass & Parnas, 2003) and in subclinical delusional ideation (Galbraith et al., 2008; Warman et al., 2007; Warman & Martin, 2006).

The findings from these four experiments add to the literature in three unique ways. Firstly, liberal acceptance has not previously been demonstrated in a non-clinical population. Secondly, this effect is evident on both delusional *and* neutral stimuli, not just implausible stimuli; previous research has only demonstrated this on delusional/ implausible materials (LaRocco & Warman, 2009; Moritz & Woodward, 2004). Thirdly, excitement about the stimulus may be an underpinning factor for why scenarios are accepted more readily by those high in delusional ideation.

No significant group difference was found for the Bridge the Associate Gap task (Gianotti et al., 2001) and thus, the prediction that high PDI scorers would generate more associative words was not supported. Instead, both groups generated more associative words for indirectly related word pairs than unrelated word pairs. Gianotti et al. (2001) found that strong paranormal believers compared to sceptics produced more original associations to unrelated word pairs however this does not appear consistent with those high in delusion ideation. Compared to the Remote Associate Test (Mednick, 1962), the Bridge the Associate Gap task has the advantage of being able to compare semantically related and unrelated word pairs in addition to all responses (associations) being accepted as valid, so there is no single, correct answer being sought after.

Nonetheless, it appears that in the present Chapter (Chapter 5) and in Chapter 4, the word associations tasks employed such as the Remotes Associates Test and the Bridge the Associate Gap task do not differentiate PDI groups or predict delusional ideation. The Remote Associate Test may act as a mediator as seen in Chapter 3 however this is in relation to lower scores in people who demonstrate high delusional ideation suggesting that those low in delusional ideation perform better on word association tasks where convergent thinking is necessary. Consistent with this notion, schizotypy has been related to divergent thinking in contrast to convergent thinking (Folley & Park, 2005). Previous research demonstrates this pattern of results, in that complex, moving objects are reported in visual displays of random dots by believers in the paranormal and schizotypes (Brugger et al., 1993; Farias et al., 2005) suggesting a 'looser' cognitive style. Tasks that employ pattern detection in visual 'noise' do not necessarily initiate convergent thinking but cognitive 'looseness' for subjective *meaningful* associations; much like the finding in Chapter 4 whereby high PDI scorers reported more embedded objects in 'snowy pictures' where no object had been embedded. It could be argued that word association tasks do not rely on making meaningful associations even if stimuli are semantically related. The meaningfulness of stimuli relies on a person's subjective evaluation rather than objective information (Gianotti et al., 2001). In addition, the literature on a JTC bias is robust in that less objective information is gathered before reaching a decision in those with delusions and delusion-prone participants (see Fine et al.,

2007) suggesting that subjective interpretations of information/ events is relied upon in subclinical delusions.

In support of this theoretical standpoint, the high PDI group reported experiencing significantly more coincidences compared to the low PDI group, supporting this prediction. Furthermore, significant, positive correlations were found between total PDI score and general coincidences, clusters of events, spontaneous associations, perceptions distant in space, perceptions distant in time and guardian angel experiences. A further analysis found that spontaneous associations, unexpected solutions and guardian angel experiences all predicted delusional ideation. It was found however that whilst unexpected solutions and small world experiences shared a non-significant positive correlation with PDI score, these shared a negative association in the regression model (significantly so for unexpected solutions). Unexpected Solutions made a significant yet negative contribution to the model suggesting that it suppressed irrelevant variance in the other predictor variables resulting in the strongest regression model when small world experiences were removed.

The final prediction was also supported with the low PDI scorers endorsing that coincidences are due to pure chance; while high PDI scorers endorsed destiny, divine intervention and everything being connected to everything else in the universe. Consistent with the present findings, Bressan (2002) reported that believers in the paranormal compared to non-believers detect more patterns and make more causal connections based on less evidence and therefore are more prone to experience a greater number of meaningful coincidences. The ability to find patterns and search for causes is, of course, useful for survival and will vary between individuals (Bressan, 2002).

However, Brugger (1997) suggests that believers in the paranormal may have a lower 'threshold of causal attribution' and a consequence of this is the need to make more causal connections between random events. Therefore, in the event that a natural cause cannot be found, a paranormal or delusional explanation may seem fitting. Fyfe and colleagues (2008) suggest that apophenia or the tendency to perceive these meaningful patterns and causal connections where none exist may be a contributing factor to the formation of paranormal as well as delusional beliefs. This is consistent with findings in the schizophrenia literature; with those experiencing delusions having a 'lowered threshold of acceptance', liberally accepting even implausible interpretations (Moritz & Woodward, 2004).

While this study has investigated the effects of associative processing and reported experiences of coincidences in those that are delusional-prone, research within this area has been mostly conducted with believers and non-believers in the paranormal and any inferences drawn between these two populations must remain tentative. Future studies should investigate similar additional factors, such as apophenia and its different forms (perceptual and non-perceptual), which may contribute to increased liberal acceptance in delusion-prone individuals.

Chapter 6 aimed to replicate the findings examining coincidental experiences that were tested in the present experiment. Additionally, narratives with delusional and neutral content have been utilised to examine liberal acceptance in the previous experiments; in Chapter 6, the task used by Moritz and Woodward, (2004) in previous studies was utilised to measure liberal acceptance.

Chapter VI

Delusional ideation and decision thresholds: Testing the liberal acceptance account

Introduction

In Chapters 2-5, narratives have been used to measure liberal acceptance in a subclinical sample. In Chapter 6, the aim was to examine if liberal acceptance could be demonstrated in a subclinical sample using materials that have been utilised previously in a clinical sample. This followed the method employed by Moritz and Woodward (2004).

Theories introduced at the beginning of this thesis, have dominated research into cognition and delusions (Moritz & Woodward, 2004). These include perceptual anomalies (Maher, 1974; 1999), attributional biases (see Bentall, & Kaney, 1996; Bentall, Kinderman, & Kaney, 1994; Kinderman & Bentall, 1996; Kinderman & Bentall, 1997) and reasoning biases - most notably the jump to conclusions bias (see Fine et al., 2007). To reiterate, there is robust evidence that those who experience delusions exhibit a number of reasoning biases. These reasoning biases, particularly the jump to conclusions bias, have been mainly investigated using probabilistic reasoning tasks such as the beads task (see Garety & Freeman, 1999; Fine et al. 2007). A strict jump to conclusions account would hold that participants would hastily choose one option and stick with this, even if this is not supported with evidence (Moritz & Woodward, 2004).

As previously discussed, Moritz and Woodward (2004) have argued for a liberal acceptance account whereby implausible information is accepted more easily by patients with schizophrenia due to a lowered threshold for acceptance. They posit that when there are several competing hypotheses, a decision may be delayed because multiple hypotheses pass the threshold for plausibility leading to greater ambiguity. Therefore, schizophrenia patients may consider a hypothesis as a plausible option but healthy participants may dismiss the hypothesis as implausible. Moritz and Woodward (2004) tested this theory using pictures from the Thematic Apperception Test and asked participants to rate various interpretations in terms of plausibility. They found that patients gave relatively high plausibility ratings for those that were rated as poor or unlikely by controls, yet patients were comparable on plausibility ratings that were rated as good or excellent by controls. Evidence was also found that contradicts a strict jump to conclusions account since participants did not converge on one particular interpretation but considered several options (Moritz & Woodward, 2004).

In the present study, six pictures from the Thematic Apperception Test (TAT; Murray, 1943) were presented and participants were asked to rate three or six interpretations of varying plausibility. In addition, the Coincidences Questionnaire (Bressan, 2002) was again employed as a measure of non-perceptual apophenia to examine if those high in delusional ideation make more causal connections where none exist.

Consistent with previous research (Moritz & Woodward, 2004), it was expected that high PDI scorers would rate more interpretations for the Thematic Apperception Test pictures as good or excellent compared to low PDI scorers but that low PDI scorers would rate more interpretations as poor or unlikely compared to high PDI scorers. It was expected that this pattern would be more pronounced for pictures with six interpretations compared to pictures with three interpretations due to greater ambiguity with six interpretations.

In addition, it was also predicted that if a strict jump to conclusions account was supported, in contrast to the liberal acceptance account, participants in the high PDI group would judge solely one interpretation as good or excellent for each picture compared to participants in the low PDI group.

Consistent with Chapter 5, it was expected that the high PDI group would report experiencing more coincidences compared to the low PDI group as well as endorse alternatives to 'pure chance' when considering what coincidences are due to.

Method

Participants

One-hundred-thirteen participants took part (94 female) with a mean age of 23.04 (S.D. = 7.43). Participants were recruited voluntarily from a large urban UK university and received course credits for their participation.

Materials

The Peters et al. Delusions Inventory (Peters, Day & Garety, 1996; Appendix 4) was again employed as a measure of delusional ideation. In addition, participants completed the Coincidences questionnaire (Bressan, 2002; Appendix 24), identical to Chapter 5.

Thematic Apperception Test - *Liberal Acceptance Measure*

Six pictures from the Thematic Apperception Test (Murray, 1943; Appendix 27) were presented and participants were asked to rate three or six interpretations of varying plausibility. The number of interpretations was manipulated (three or six interpretations) in order to test whether the level of ambiguity would affect task performance. The plausibility ratings per interpretation were recorded as follows: *1 = does not fit/poor interpretation, 2 = possible interpretation but not likely, 3 = good interpretation, 4 = excellent interpretation.* Cards displaying dominant aggression (e.g., card 15, man among gravestones), nudity (e.g., picture 17BM, naked man) or pictures with only few details (e.g., picture 16 which is a blank card) were excluded.The Thematic Apperception Test was chosen because many of its pictures evoke a variety of different interpretations and the use of this stimulus material is consistent with previous research (Moritz & Woodward, 2004). This test is illustrated in Figure 5 below.

Please look at the picture and rate each interpretation below as either: *1 = does not fit/poor interpretation, 2 = possible interpretation but not likely, 3 = good interpretation, 4 = excellent interpretation.*

- Smugglers are loading stolen goods from ships into a warehouse. The person on the bridge is a detective watching.
- The sun is exploding; meteorites are crashing down the earth. The men try to move them away or even catch them.
- The woman is sick, perhaps from the sun, or the smell of the goods the workers are carrying, and is about to vomit.
- From a bridge, a rich woman is supervising her servants who are moving boxes into her new house or factory.
- The woman is complaining about the noise the workers are making or perhaps the smell of the goods they are carrying.
- A woman on the bridge is thinking whether or not she should jump from the high bridge.

Figure 5. *Illustration of the Thematic Apperception Test (Murray, 1943) used as a measure of liberal acceptance*

Design

A mixed design was employed with PDI group (high/ low) as the between groups variable and response options (does not fit/ poor interpretation, possible but not likely interpretation, good interpretation and excellent interpretation) as the within-group variable. The total number of interpretations assigned to each response option served as the dependent variable. The other dependent variable was the scores from the coincidence measure.

Procedure

All measures were completed via an online survey platform. Once informed consent was complete, participants then completed the coincidences questionnaire, followed by viewing each of the six pictures from the Thematic Apperception Test and assigning plausibility ratings to either three or six interpretations. Finally, participants completed the Peters et al. Delusions Inventory. A debrief page was displayed thanking participants for taking part and detailing the researcher's details.

Results

Total PDI scores were used to divide participants into high and low scoring groups. A median split was conducted and those scoring up to and including the median of 48 made the low PDI group, while those scoring over the median made the high PDI group. There were 57 participants in the low PDI group and 56 participants in the high PDI group. Independent t-tests revealed a significant difference between males and females and PDI score (t(111) = -2.02; p = 0.05). There was also a significant

PDI group difference in age (*t* (94.54) = 2.02; *p* = 0.05). Summary statistics are displayed in Table 6.1.

Table 6.1

Summary statistics for high and low PDI groups

	High PDI Group *(n)*	Low PDI Group *(n)*	PDI *Mean (S.D.)*
Female	49	45	58.71 (43.40)
Male	7	12	37.47 (32.52)
	Mean (S.D.)	*Mean (S.D.)*	-
Age	21.64 (5.51)	24.42 (8.76)	-
PDI Score	85.75 (39.11)	25.07 (15.37)	-

Thematic Apperception Test

Two-way ANOVAs were conducted with PDI group (high/ low) as the between groups variable and response options (does not fit/ poor interpretation, possible but not likely interpretation, good interpretation and excellent interpretation) as the within-group variable. The total number of interpretations assigned to each response option served as the dependent variable. The data did not approximate a normal distribution ($p < .05$; see Appendix 36) however this was expected due to the nature of the task and ANOVA is considered robust enough to manage deviations from normality (Kim, 2013). The Levene's tests found that homogeneity of variance had been met for all comparisons ($p > .05$).

The first analysis examined the total number of interpretations assigned to each response option when response options were collapsed across pictures with three and six interpretations. There was no main effect of PDI group ($F(1, 110) = 0.22$; $p = 0.64$; $\eta p^2 = 0.002$). The main effect of response option was significant ($F(3, 110) = 76.9$; $p < 0.01$; $\eta p^2 = 0.41$). Participants chose the 'possible but not likely' option most often and the excellent option least often. Simple contrasts revealed a significant difference between poor and unlikely response options ($p = 0.02$) and poor and excellent response options ($p < 0.01$). The interaction was not significant ($F(1, 110) = 0.28$; $p = 0.64$; $\eta p^2 = 0.003$). As can be seen from Table 6.2, there is not much difference on the overall ratings between the high and the low PDI groups on the various response options.

Table 6.2

Mean values (standard deviations in parenthesis) for response options between high and low PDI groups across three and six interpretations

	High PDI	Low PDI	Overall
Does not fit/ poor interpretation	7.61 (4.68)	7.93 (4.54)	7.77 (4.61)
Possible interpretation but not likely	9.61 (3.56)	9.18 (4.54)	9.4 (4.05)
Good interpretation	7.80 (3.81)	7.93 (3.44)	7.87 (3.63)
Excellent interpretation	1.63 (2.2)	1.38 (1.86)	1.51 (2.03)
Overall	6.66 (3.56)	6.61 (3.6)	6.64 (3.58)

The second analysis examined the total number of interpretations assigned to each response option when there were three response options. The data did not approximate a normal distribution ($p < .05$; see Appendix 36). Homogeneity of variance was met for all comparisons ($p > .05$). The main effect of PDI group was not significant (F (1, 110) = 0.59; p = 0.44; ηp^2 = 0.005). The main effect of response option was significant (F (1, 110) = 39.402; $p < 0.001$; ηp^2 = 0.264). As can be seen from Table 6.3, the excellent option was chosen least often. Simple contrasts revealed significant differences between all response options ($p < 0.001$). The interaction between PDI group and response option was not significant (F (1, 110) = 0.451; p = 0.72; ηp^2 = 0.004).

Table 6.3

Mean values (standard deviations in parenthesis) for response options between high and low PDI groups across three interpretations

	High PDI	Low PDI	Overall
Does not fit/ poor interpretation	2.14 (1.76)	2.43 (1.62)	2.29 (1.69)
Possible interpretation but not likely	3.16 (1.56)	2.95 (1.84)	3.06 (1.7)
Good interpretation	2.84 (1.58)	2.79 (1.45)	2.82 (1.52)
Excellent interpretation	0.82 (1.25)	0.68 (0.96)	0.75 (1.11)
Overall	2.24 (1.54)	2.21 (1.47)	2.23 (1.51)

The final analysis examined the total number of interpretations assigned to each response option when there were six response options. Again, the data did not approximate a normal distribution ($p < .05$; see Appendix 36). Homogeneity of variance was met for all comparisons ($p > .05$). The main effect of PDI group was not significant (F (1, 110) = 0.102; $p = 0.75$; $\eta p^2 = 0.001$). The main effect of response option was significant (F (1, 110) = 73.8; $p < 0.001$; $\eta p^2 = 0.62$). The excellent option was chosen least often (see Table 6.4). Simple contrasts showed a significant difference between all response options ($p < 0.001$). The interaction was not significant (F(1, 110) = 0.09; $p = 0.97$; $\eta p^2 = 0.001$).

Table 6.4

Mean values (standard deviations in parenthesis) for response categories between high and low PDI groups across six interpretations

	High PDI	Low PDI	Overall
Does not fit/ poor interpretation	5.46 (3.31)	5.5 (3.34)	5.48 (3.33)
Possible interpretation but not likely	6.45 (2.68)	6.23 (3.25)	6.34 (2.97)
Good interpretation	4.96 (2.82)	5.14 (2.74)	5.05 (2.78)
Excellent interpretation	0.8 (1.38)	0.7 (1.04)	0.75 (1.21)
Overall	4.15 (2.55)	4.39 (2.59)	4.27 (2.57)

In line with previous research, it was tested how often participants judged solely one interpretation for each picture as good or excellent between high and low PDI groups. For pictures with three interpretations the low PDI group had a single preference in 86.3% of the trials compared to 84.7% in the high PDI group. The difference between the groups was not significant (χ^2 (df = 2) = 0.394; p = 0.82).

For all pictures with six interpretations, the low PDI group had a single preference in 23.4% of the trials compared to 27.2% in the high PDI group. Again, the difference between the groups was not significant (χ^2 (df = 2) = 0.826; p = 0.66).

Coincidences

An Independent samples t-test was used to examine the difference between high and low PDI groups and the total number of coincidences reported. The data approximated a normal distribution ($p > .05$; see Appendix 36) and homogeneity of variance was met ($p > .05$). There was a significant difference between high and low PDI groups ($t\,(111) = -02.44$; $p = 0.02$) with the high PDI groups mean score being 21.43 (SD = 5.39) and low PDI groups mean score being 19.04 (SD = 5.02).

Data were further analysed using Spearman's correlation to examine if there was any relationship between total PDI score and categories of coincidences. Significant positive correlations were found between total PDI score and General Coincidences ($r\,(112) = 0.253$; $p < 0.01$), Spontaneous Associations ($r\,(112) = 0.343$; $p <0.01$), Small World Experiences (r (112) = 0.315; $p = 0.01$), Perceptions Distant in Space (r = (112); 0.256; $p < 0.01$), Perceptions Distant in Time ($r\,(112) = 0.259$; $p < 0.01$) and Guardian Angel Experiences ($r\,(112) = 0.301$; $p < 0.01$). Clusters of Events (r = (112); 0.06; $p = 0.26$) and Unexpected Solutions ($r\,(112) = 0.132$; $p = 0.08$) did not correlate significantly with PDI score.

A multiple linear regression analysis incorporating the variables: Guardian Angel Experiences, General Coincidences, Perceptions Distant in Time, Perceptions Distant in Space, Small World Experiences, Clusters of Events, Spontaneous Associations and Unexpected Solutions significantly predicted PDI score ($F\,(8, 103) = 4$; $p < 0.01$; $R^2 = 0.24$) with 24% of the variance in PDI scores being explained by the model (Durbin Watson = 1.92). As can be seen from Table 6.5, Spontaneous

Associations (*Beta* = 0.23; *p* = 0.03) and Perception Distant in Space (*Beta* = 0.21; *p* = 0.05) were the only predictors that made a significant contribution to the model. However, Guardian Angel Experiences (*Beta* = 022; *p* = 0.06), Small World Experiences (*Beta* = 0.19; *p* = 0.07) and Clusters of Events (*Beta* = 0.23; *p* = 0.07) were found to be approaching significance.

Table 6.5

Mean (standard deviation in parenthesis), Beta, t values, p-values, partial correlations and VIF for Guardian Angel Experiences, General Coincidences, Perceptions Distant in Time, Perceptions Distant in Space, Small World Experiences, Clusters of Events, Spontaneous Associations and Unexpected Solutions.

Variable	Mean (S.D.)	Beta	*t* value	*p* value	Partial correlations	VIF
Guardian Angel Experiences	2.46 (0.99)	0.22	1.92	0.06	0.19	1.79
General Coincidences	2.95 (0.77)	0.1	0.09	0.93	0.01	1.82
Perceptions Distant in Time	2.39 (1.08)	0.38	0.35	0.73	0.03	1.62
Perceptions Distant in Space	1.86 (1.05)	0.21	1.97	0.05	0.19	1.52
Small World Experiences	2.89 (1.03)	0.19	1.83	0.07	0.18	1.58
Clusters of Events	2.54 (0.91)	-0.19	-1.82	0.07	-0.18	1.44
Spontaneous Associations	3.05 (0.93)	0.23	2.11	0.04	0.20	1.64
Unexpected Solutions	2.17 (1.03)	-0.18	-1.61	0.11	-0.16	1.63

Finally, two-way Chi-Square tests were used to investigate if there were any associations between PDI group and what participants thought coincidences were due to. There was a significant association between PDI group and Pure Chance (χ^2 (df = 2) = 8.28*;* p = 0.02), Destiny (χ^2 (df = 2) = 9.73*;* p < 0.01), Divine Intervention (χ^2 (df = 2) = 6.7*;* p = 0.04) and Extra Sensorial Perception (χ^2 (df = 2) = 11.07*;* p < 0.01). It appears that those in the low PDI group attribute coincidences to pure chance, while those in the high PDI group appear to attribute coincidences mostly to destiny. No significant associations were found between PDI group and Intuition, Physical Principles Not Yet Discovered by Science and Everything Being Connected to Everything Else in the Universe ($p \geq 0.15$).

Discussion

In Chapters 2-5, the findings have been suggestive of a liberal reasoning style when assessing narratives containing delusional and neutral themes. The present study aimed to examine if a liberal acceptance reasoning style would be evident in a subclinical sample using materials that have been previously employed in a clinical sample in the published literature. In line with Moritz and Woodward (2004), the first prediction was that high PDI scorers would rate more interpretations for the Thematic Apperception Test pictures as good or excellent compared to low PDI scorers and that low PDI scorers would rate more interpretations as poor or unlikely compared to high PDI scorers. In the present study, it was found that when trials were collapsed over three and six interpretations, the high PDI group rated more interpretations as excellent compared to the low PDI group and the low PDI group rated more interpretations as poor but this interaction did not achieve significance. Neither was the difference between the PDI groups significant.

Furthermore, it was expected that this effect may be more pronounced for pictures with six interpretations compared to pictures with three interpretations due to greater ambiguity but this effect did not emerge. For three interpretations, the low PDI group rated more interpretations as poor compared to the high PDI group, while the high PDI group rated more interpretations as possible but not likely, good or excellent interpretations but this interaction again did not achieve significance. Similarly, for pictures with six interpretations the low PDI group rated more interpretations as poor compared to the high PDI group and high PDI scorers rated more interpretations as excellent compared to the low PDI group but no significant interaction was found. It may be that while this liberal acceptance task using pictures from the Thematic Apperception Test was able to differentiate between healthy participants and schizophrenic patients in previous research (e.g. Moritz & Woodward, 2004), the task is not sensitive enough to be able to differentiate between participants that are classified as high or low in delusional ideation in a subclinical sample. One explanation is that, some interpretations were simply too implausible to be accepted, even by participants in the high PDI group. For example, the meteorite explanation in Figure 5 (The sun is exploding, meteorites are crashing down the earth. The men try to move them away or even catch them) was not deemed plausible by healthy participants in Moritz and Woodward's (2004) study, however, was an explanation that was thought possible by patients with schizophrenia. Across the pictures with three interpretations, six interpretations and when trials were collapsed across both three and six interpretations, mean scores indicate that the 'possible but unlikely' option was chosen most often, particularly by high PDI scorers, suggesting that interpretations were thought of as at least possible. This may point to evidence of a liberal acceptance reasoning style in high PDI scorers for implausible interpretations but must, of course, remain tentative.

Consistent with Moritz and Woodward's (2004) study, a strict jump to conclusions account was also examined. This investigated how often participants judged solely one interpretation for each picture as good or excellent between high and low PDI groups. It was expected that if participants displayed a jump to conclusions bias, they would stick with one interpretation even if it was not supported by evidence. This was not the case – for pictures with three interpretations, the low PDI group displayed a single preference more often that the high PDI group but this difference was not significant. For pictures with six interpretations, the high PDI group displayed a single preference more often than the low PDI group but similarly, the difference was not significant suggesting that a strict jump to conclusions style was not supported.

Despite previous research demonstrating a jump to conclusions bias in a subclinical sample (e.g. Colbert & Peters, 2002), the findings from the present study do not support this position. Participants in the high PDI group did not jump to conclusions significantly more often than participants in the low PDI group regardless of whether there were three or six interpretations for each picture. Moritz and Woodward (2004) propose that the jump to conclusions bias may not be evident when there are several competing hypotheses since this creates greater ambiguity leading to more than one hypothesis surpassing this lowered threshold for acceptance. For instance, it has been found that when the number of jars in the beads task is increased to three rather than two, hasty decision making disappears in delusion-prone participants (Bensi et al., 2010). The increased number of alternative jars leads to greater ambiguity since multiple alternatives cross this lowered threshold of acceptance, although there have been contradictory findings to this account (White & Mansell, 2009). There was however some evidence to support the liberal acceptance notion in the present study since the percentage of single preferences were greater for pictures that had three interpretations than pictures with six interpretations meaning that for pictures with six interpretations greater ambiguity led to more of the interpretations being accepted as plausible.

Consistent with Chapter 5, high PDI scorers reported significantly more coincidences in comparison to low PDI scorers. Furthermore, significant positive correlations were found between total PDI score and General Coincidences, Spontaneous Associations, Small World Experiences, Perceptions Distant in Space, Perceptions Distant in Time and Guardian Angel Experiences. A further multiple linear regression analysis found that spontaneous associations and perceptions distant in space significantly predicted delusional ideation. Guardian Angel Experiences, Small World Experiences and Clusters of Events were found to be approaching statistical significance. Finally, it was found that low PDI scorers tended to attribute coincidences to pure chance while high PDI scorers tended to attribute coincidences mainly to destiny. This is consistent with findings from Chapter 5 and suggests that high PDI scorers see patterns and make more causal connections where none exist in comparison to low PDI scorers and could be an underpinning factor in the formation of delusional beliefs (Fyfe et al., 2008). In addition, it could be argued that the causal connections made from coincidental experiences by high PDI scorers and the multiple explanations that are accepted for the occurrence of coincidences (i.e. destiny, divine intervention etc.) are entertained as plausible due to a liberal reasoning style.

In summary, the findings from Chapter 5 were replicated in the present Chapter (Chapter 6) in terms of high PDI scorers' tendency to experience a greater number of coincidences in comparison to low PDI scorers and attribute coincidences to other factors apart from pure chance. However, using materials that have previously been employed in a clinical sample to measure liberal acceptance did not yield significant differences between those high and low in delusional ideation in the present study. In Chapter 7, liberal acceptance was again measured, again using a task that has been utilised previously in a clinical sample.

Chapter VII

Delusional Ideation and Decision Thresholds: Who wants to be a Millionaire?

Introduction

In Chapter 6, the method employed by Moritz and Woodward (2004) using the Thematic Apperception Test was utilised to measure liberal acceptance in a subclinical sample. In Chapter 7, the aim was again to utilise materials that have been used previously in the published literature to measure liberal acceptance. This time, to measure liberal acceptance, a method employed by Moritz et al. (2006) was utilised. In this research (Moritz et al., 2006), a new paradigm was designed after the 'Who wants to be a Millionaire' television game show. In this task, patients with schizophrenia and healthy participants were asked to answer general knowledge questions from four possible response options (only one of the options was correct). After each question participants were asked to give a probability estimate between 0% and 100% and then asked if they could decide in favour of one of the options or rule out one or more of the options. This allowed for two separate measures – one for probability estimates and one for decisions and rejections made. This enabled researchers to determine when a probability estimate translated into a decision. In other words, the subjective confidence in a decision could be observed experimentally in the form of the probabilities that correspond to each decision and rejection. Unlike tasks measuring the jump to conclusions bias (in particular, tasks using the draws to decision method), decisions based on low probability estimates could not be because of a preference to prematurely end the task since the decision or rejection of an option would prolong the task rather than terminate it in this experimental paradigm (Moritz et al., 2006). Additionally, it is likely that if liberal acceptance was evident, then patients would be more likely to make this type of error, i.e. considering several differing options as plausible; thus leading to a task that is deemed as ecologically valid when testing for underpinning factors for the development of fixed, delusional beliefs.

In Moritz et al's (2006) study, it was found that there was no difference between patients and healthy participants in terms of probability estimates given to response options. This is consistent with previous research demonstrating no differences between patients and healthy participants in estimating probabilities (Dudley et al., 1997a) and that comprehension problems are also highly unlikely in patients (Moritz & Woodward, 2005). Furthermore, there was no difference between patients and healthy participants on correct decisions made - correct decisions were made comparably often. However, patients with schizophrenia made significantly more incorrect decisions and endorsed decisions even when probability estimates were low while healthy participants based their decisions on higher probability estimates. In addition, patients rejected options despite rather high probability estimates. This research demonstrates that not only are patients more willing to make a decision, even in the face of low subjective probabilities, options tend to be rejected more easily too, despite higher subjective probabilities.

Moritz and colleagues (2006) argued that these findings provide support for the liberal acceptance account. It demonstrates that liberal acceptance is evident in patients when ambiguity between response options is high. Several competing response options to the questions may cross the threshold of acceptance leading to a delayed and potentially incorrect decision. Liberal acceptance provides a parsimonious explanation for this reasoning style. This is supported by research demonstrating that the jump to conclusions reasoning style tends to disappear in situations when ambiguity is high (Moritz et al., 2007). This has led to the assertion that a jump to conclusions reasoning style tends to emerge when the number of response options is limited and it is very obvious when one particular option is the correct choice relative to other options (Moritz et al., 2007).

In the present study, the aim was to examine if liberal acceptance would emerge in a subclinical sample of participants classified as high or low in delusional ideation using the above 'Who wants to be a Millionaire' experimental paradigm proposed by Moritz and colleagues. In line with Moritz et al. (2006), it was expected that participants high in delusional ideation would display a liberal acceptance reasoning style compared to participants low in delusional ideation. In other words, that participants high in delusional ideation would make decisions based on lower probability estimates – probability estimates that would be deemed insufficient to make a decision in those low in delusional ideation. It was also expected that high PDI scorers would make more incorrect decisions and base rejections on higher probability estimates compared to low PDI scorers.

Method

Participants

Eighty-nine participants took part (71 female) with a mean age of 22.2 (S.D. = 6.29). Participants were recruited voluntarily from a large urban UK university and received course credits for their participation.

Materials

The Peters et al. Delusions Inventory, (Peters, Day & Garety, 1996; Appendix 4) was again employed as a measure of delusional ideation.

'Who wants to be a Millionaire' task - Liberal Acceptance Measure

Participants were asked to answer twenty general knowledge questions with four possible options. For each alternative answer, the participant was asked to assign a probability estimate between 0% and 100% (using 10% increments) and then asked if they could decide in favour of one of the options (decision) or could rule out one or more of the available options (rejection). There was also a 'Can't be absolutely sure' option. Two practice questions were included (Appendix 31).

Participants could assign all estimates first and then indicate the answers they thought were correct or not; they could also go back and forward through questions. Participants did not receive feedback about whether they had answered the questions correctly or not. Standard instructions were as shown below:

> Below are 20 general knowledge questions. For each of the four answers, we would like you to give a probability estimate between 0% and 100%. There

are no right or wrong probably estimates and you should give an estimate that you think is about right. Even if you are entirely certain that an answer is correct, please still give a probability estimate for each answer.

We would also like you to decide which answer you think is right or wrong. Sometimes you absolutely know that something is right or wrong, at other times you can’t be sure. When you feel that you really can't make a decision, there is an additional option of 'can't be absolutely sure' for this. You can decide which answer is right or wrong (or if you 'can't be absolutely sure') after each estimate you provide or after you have given estimates to all four answers. You can also go back to previous questions if you change your mind.

Please see the example scenarios below for guidance on completing this part of the survey:

Example 1

You are asked the question: How many fingers does Mickey Mouse have?

The four alternative answers are 10, 12, 8 and 6. You think that the answer could be that Mickey Mouse has either 10 or 8 fingers. So you give 50% for the answer 10 fingers and 50% for the answer 8 fingers. You think the chance of Mickey Mouse having 12 fingers is small, so you give this 20% and the chance of Mickey Mouse having 6 fingers is even smaller, so you give this 10%. You decide to go for the answer of Mickey Mouse having 10 fingers and indicate this by choosing 'I would say this is right'. You may still be unsure about whether Mickey Mouse has 8 fingers so for this you might choose 'can't be absolutely sure'. For the other alternative answers (12 and 6 fingers) you choose 'I would say this is wrong'.

Example 2

You are asked the question: Which one of the following is not a character from the standard edition of the board game Cluedo?

The four alternative answers are Captain Scarlett, Professor Plum, Reverend Green and Mrs White. You are pretty sure that the answer is not Mrs White or Reverend Green and you give these both 20% and choose 'I would say this is wrong'. You are less certain about Professor Plum so you give this 30% and choose 'can't be absolutely sure'. You give the remaining answer (Captain Scarlett) 40% and choose 'I would say this is right'.

Below are 2 trial questions for you to practice this task. You will then begin the 20 general knowledge questions.

Design

A between groups design was employed with delusion-prone groups (high/ low) as the between groups variable. There were two dependent variables based on the scores from the 'Who wants to be a Millionaire' liberal acceptance task. These were the probability estimates given to alternative answers and decisions and rejections for alternative answers.

Procedure

All measures were completed via an online survey platform. Informed consent was completed by checking a number of statements before beginning the study. Participants then completed the twenty general knowledge questions as a measure of liberal acceptance after which the Peters et al. Delusions Inventory was completed. A debrief page was displayed thanking participants for taking part and detailing the researcher's details.

Results

Total PDI scores were used to divide participants into high and low scoring groups. A median split was conducted and those scoring up to and including the median of 36 made the low PDI group, while those scoring over the median made the high PDI group. There were 45 participants in the low PDI group and 44 participants in the high PDI group. Independent t-tests revealed no significant difference between males and females and PDI score (t (87) = 1.39; p = 0.17). There was also a non-significant PDI group difference in age (t (68) = 1.82; p = 0.07). Summary statistics are displayed in Table 7.1.

Table 7.1

Summary statistics for high and low PDI groups

	High PDI Group *(n)*	Low PDI Group *(n)*	PDI *Mean (S.D.)*
Female	38	33	44.41 (37.99)
Male	6	12	31 (29.26)
	Mean (S.D.)	*Mean (S.D.)*	-
Age	21 (4.15)	23.38 (7.71)	-
PDI Score	69.07 (33.21)	14.93 (11.24)	-

'Who wants to be a Millionaire' task

Independent sample *t*-tests were used to analyse differences between high and low PDI groups on the 'Who wants to be a Millionaire' task consistent with the analysis carried out by Moritz et al. (2006). The data was not normally distributed ($p > .05$; see Appendix 36 for exploratory analysis and equivalent non-parametric tests). Homogeneity of variance was met for all comparisons ($p > .05$) except for the number of incorrect rejections ($p < .05$).

The first analysis examined mean probability estimates for correct decisions between high and low PDI groups. The difference between the groups mean probability estimates for correct decisions was not significant (t (77) = -1.19; p = 0.24). The second analysis examined mean probability estimates for incorrect decisions. The difference between the mean probability estimates for the high and the low PDI groups was also not significant (t (76) = -0.64; p = 0.53). As can be seen from Figure 6, the probability estimates between the groups were very similar.

Subsequent independent t-tests examined the minimum probability estimate given for correct and incorrect decisions and whether these differences between high and low PDI groups were significant. No significant difference was found between the minimum probability estimates for correct decisions (t (82) = -0.22; p = 0.83). The difference between the groups for the minimum probability estimates for incorrect decisions was also non-significant (t (76) = -0.96; p = 0.34) (see Figure 6).

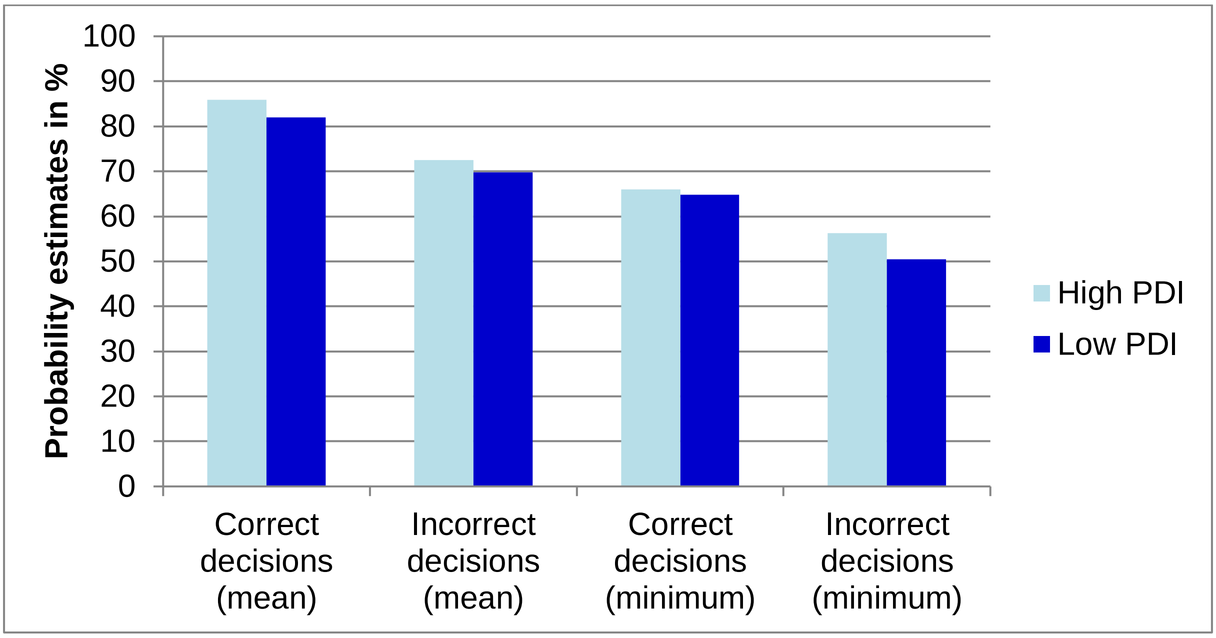

Figure 6. *Mean and minimum probability estimates for correct and incorrect decisions between high and low PDI groups*

The next analysis examined mean probability estimates for correct and incorrect rejections between high and low PDI groups. The difference between the groups' probability estimates was not significant for correct rejections (t (80) = 0.183; p = 0.86). Neither was the difference significant between the probability estimates for incorrect rejections between the groups (t (77) = -0.046; p = 0.96).

In addition, the maximum probability estimate for correct and incorrect rejections was examined between the high and low PDI groups. The difference between the maximum probability estimates was not significant between the groups for correct rejections (t (80) = 0.459; p = 0.65) nor was it significant for incorrect rejections (t (77) = -0.518; p = 0.61).

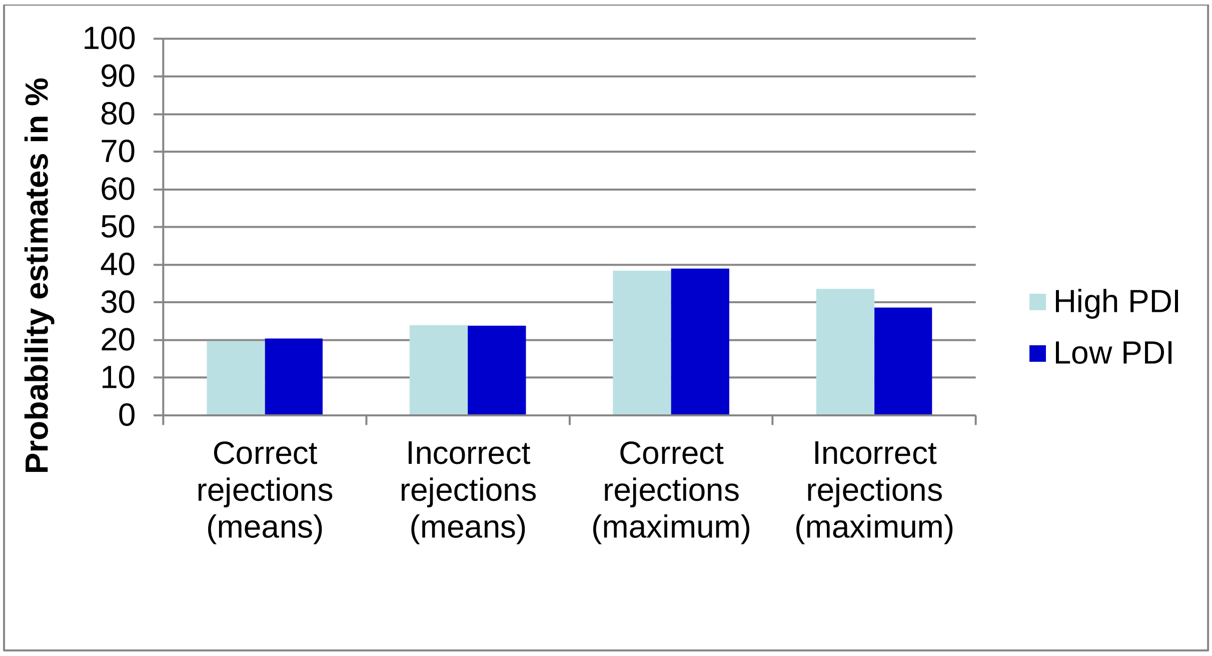

Figure 7. *Mean and maximum probability estimates for correct and incorrect rejections between high and low PDI groups*

Finally, the number of correct and incorrect decisions and rejections was examined between high and low PDI groups. The difference between the groups was not significant for the number of correct (t(87) = -0.33; p = 0.74) or incorrect decisions (t(87) = 1.48; p = 0.14).

Additionally, the difference was not significant between the groups for the number of correct rejections (t(87) = -1.08; p = 0.28). Neither was the difference significant for the number of incorrect rejections between the groups (t(87) = 0.21; p = 0.84). Descriptive statistics are displayed in Figure 8.

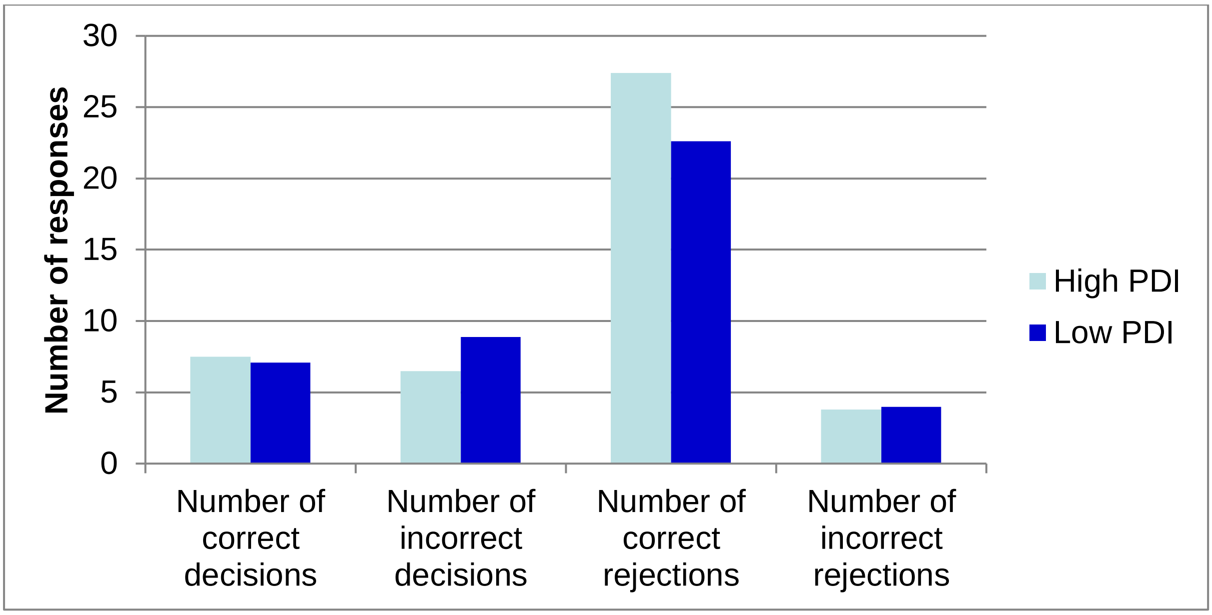

Figure 8. *The number of correct and incorrect decisions and rejections between high and low PDI groups*

Discussion

The present Chapter (Chapter 7) aimed to examine if a liberal acceptance reasoning style would be evident in a subclinical sample using a general knowledge test similar to the 'Who wants to be a Millionaire' game show. This new paradigm has been employed previously in a clinical sample to examine the liberal acceptance account (Moritz et al., 2006).

In line with Moritz et al. (2006), it was expected that participants high in delusional ideation would make more incorrect decisions compared to participants low in delusional ideation but this prediction was not supported. The difference was not significant and incorrect decisions were made equally often between the groups. It was also expected that participants high in delusional ideation compared to participants low in delusional ideation would base decisions on lower probability estimates consistent with a liberal reasoning style but this difference was also non-significant between the groups. Finally, it was expected that participants high in delusional ideation would reject answers even in the face of high probability estimates compared to those low in delusional ideation but again, the difference between the groups was not significant.

Consistent with Moritz et al. (2006), no difference emerged between the groups for the number of correct decisions made, nor was there any difference between the estimates of likelihood for correct and incorrect answers. This supports the view that biases in reasoning cannot easily be attributed to difficulties in estimating likelihoods (e.g. Dudley et al., 1997a). In addition, differences cannot be attributed to deficiencies in semantic knowledge since no differences were found to be significant between the groups for the number of correct decisions made. However, unlike patients in Moritz et al’s (2006) study, participants high in delusional ideation did not make more incorrect decisions than those low in delusional ideation in the present study. In addition, participants in the present study made decisions and rejections based on similar probability estimates meaning that the threshold for acceptance in terms of estimating likelihoods and translating these into decisions and rejections was similar between the groups. This would suggest that participants high in delusional ideation in the present study did not display an incautious type of reasoning to the same extent as patients with schizophrenia. As such, participants classified as high in delusional ideation did not endorse a response option (i.e. make a decision) in the face of low probability estimates nor did they reject response options in the face of high probability estimates. There are several reasons why this might be the case.

While the task employed is a novel and effective way of testing the liberal acceptance account in a clinical sample, it may not be sensitive enough to detect similar trends in a subclinical sample. Consistent with this, participants in the present study displayed rather low levels of delusional ideation; even participants in the high delusional ideation group did not display exceptionally high scores. This would imply that a stricter acceptance threshold had potentially been employed when making decisions and rejections making it less likely that trends would emerge consistent with the liberal acceptance account when utilising a task such as the one in the present study. However, the original study upon which this is based did not distinguish between delusional and non-delusional patients with schizophrenia. Therefore, findings remain tentative in terms of whether this relates to current delusional state.

In the original study (Moritz et al., 2006) the aim was to examine the jump to conclusions bias using a novel task. Using such a novel task would ensure that the jump to conclusions bias displayed by patients with delusions was not simply due to features of a specific task, such as the beads task, where options are only limited to two choices. It also demonstrated that when ambiguity is high, liberal acceptance offers a parsimonious explanation for the reasoning style displayed by patients with schizophrenia, with more options crossing the acceptance threshold.

In summary, using materials that have previously been employed in a clinical sample to measure liberal acceptance did not yield significant differences between those high and low in delusional ideation in the present study. In Chapter 8, the final study in this thesis, the aim was again to employ materials that had previously been utilised in the published literature to examine reasoning but also to combine these with the new materials constructed by the author, to make a direct comparison.

Chapter VIII

Liberal acceptance and underpinning factors of subclinical delusional ideation

Introduction

In Chapters 6 and 7, materials utilised in the published literature to examine reasoning in patients with schizophrenia were employed to examine reasoning in a subclinical sample. By conducting research in this way, it was expected that reasoning styles similar to patients with delusions would be displayed by participants in the subclinical population who are classified as high in delusional ideation, consistent with the continuum model of psychosis (van Os et al., 2009). In previous research, it has been demonstrated that healthy participants who score highly on measures of delusional ideation display a similar reasoning style to patients with delusions (e.g. Colbert & Peters, 2002; LaRocco & Warman, 1999). In Chapters 6 and 7, using materials that have previously been employed in clinical samples, differences in reasoning between participants classified as high and low in delusional ideation had not been demonstrated. In the present study, the aim was to draw this research together to examine materials utilised in Chapters 2-5 and to examine materials used in Chapter 6 within the same study.

Previously (Chapters 2-5), narratives containing delusional and neutral themes were constructed and used to examine reasoning in participants classified as high or low in delusional ideation. These studies demonstrated that participants high in delusional ideation tended to rate narratives as more likely to be true and more exciting than participants low in delusional ideation. Within this thesis, it has been argued that this evidence is consistent with a liberal acceptance reasoning style.

In addition to this, the focus of this thesis has also been to investigate underpinning factors or mechanisms for why people may liberally accept. Factors identified appear to be likelihood of being true and the excitement of stimuli. Additionally, the tendency to make meaningful connections or causal connections where none exist (apophenia) has also been implicated. These were considered again in this final experiment.

Participants in this study assessed the same series of narratives with both delusional and neutral themes in terms of 'likelihood of being true', 'exciting to the self' and 'exciting to others', identical to Chapter 4 and 5. The Thematic Apperception Test (Murray, 1943) was also employed as a measure of liberal acceptance as in Chapter 6. These measures are important since the first measure of liberal acceptance used in Chapters 4 and 5 (narratives) was constructed by the author but the second measure of liberal acceptance has been taken from the published literature and has been used to demonstrate liberal acceptance in a clinical sample.

Apophenia was again measured as this appears to be an important variable to the liberal acceptance account. This was carried out by employing both a perceptual and non-perceptual task as in Chapter 4 and 5. The Snowy Pictures Task (Ekstrom et al., 1976) was utilised as a perceptual apophenia task, identical to Chapter 4. In addition, the Coincidences Questionnaire (Bressan, 2002) was used as a non-perceptual apophenia task, identical to Chapter 5.

It was expected that the high PDI group would rate delusional narratives as more likely to be true and more exciting than the low PDI group. Consistent with a liberal acceptance account, it was expected that high PDI scorers would rate more interpretations for the Thematic Apperception Test pictures as good or excellent compared to low PDI scorers but that low PDI scorers would rate more interpretations as poor or unlikely compared to high PDI scorers.

In terms of apophenia, it was expected that high PDI scorers would detect more objects in the Snowy Pictures Task where no object has been embedded in the snowy images. Finally, it was predicted that the high PDI group would report experiencing more coincidences compared to the low PDI group as well as endorse more alternatives to 'pure chance' when considering what coincidences are due to.

Method

Participants

Eighty-three participants took part (81 female) with a mean age of 22.89 (SD = 7.7). Participants were recruited voluntarily from a large urban UK university and received course credits for their participation.

Materials

Delusional Ideation

The Peters et al. Delusions Inventory, (Peters, Day & Garety, 1996; Appendix 4) was again employed as a measure of delusional ideation.

Narratives

Participants assessed a series of narratives with delusional and neutral themes in terms of 'likelihood of being true', 'excitement to the self' and 'excitement to others', identical to Chapters 4 and 5 (Appendix, 18 & 19).

Thematic Apperception Test (Murray, 1943)

Six pictures from the Thematic Apperception Test (TAT; Murray, 1943; Appendix 27) were presented and participants were asked to rate three or six interpretations of varying plausibility, identical to Chapter 6.

Snowy Pictures Task (Ekstrom et al., 1976)

This task involves viewing 24 images. Twelve of the images contain objects embedded in 'noise' while 12 of the images contain no objects. Participants are asked to indicate if they can see an object and what it is they can see in the images (see Chapter 4; Appendix 20).

Coincidences Questionnaire (Bressan, 2002)

This questionnaire consists of 15 items divided into three sections. The first section measures how often participants have come across meaningful coincidences. The second section measures coincidences in various categories and the final section asks what participants think coincidences are due to. This followed the same procedure as Chapter 5 (Appendix 24).

Design

A mixed design was employed with PDI group (high/ low) being the between-groups factor and Narratives (delusional/ neutral) and Perspective (self/ other) as within-group factors. The dependent variables were: likelihood of being true, exciting to the self and exciting to others. The other dependent variables were the scores from the Snowy Pictures task, the Coincidences questionnaire and the plausibility ratings from the Thematic Apperception Test.

Procedure

All measures were completed via an online survey platform. Informed consent was completed by checking a number of statements before beginning the study. Participants assessed a series of delusional and neutral narratives. They then went on to view each of the six pictures from the Thematic Apperception Test and assigned plausibility ratings to either three or six interpretations. Participants then completed the coincidences questionnaire and the Snowy Pictures Task. Finally, participants completed the Peters et al. Delusions Inventory. A debrief page was displayed thanking participants for taking part and detailing the researcher's details.

Results

Total PDI scores were used to divide participants into high and low scoring groups. A median split was conducted and those scoring up to and including the median of 49 comprised the low PDI group (*n* = 43) while those scoring above the median comprised the high PDI group (*n* = 40). Independent t-tests revealed no significant PDI group differences in age (t (81) = -0.41; p = 0.68). In addition, no significant difference was found between males and females and PDI score (t (81) = -0.67; p = 0.51).

Table 8.1

Summary statistics for high and low PDI groups

	High PDI Group *(n)*	Low PDI Group *(n)*	PDI *Mean (S.D.)*
Female	40	41	57.73 (43.64)
Male	0	2	37 (11.31)
	Mean (S.D.)	*Mean (S.D.)*	-
Age	23.24 (7.09)	22.55 (8.32)	-
PDI Score	88.8 (39.64)	26.52 (15.54)	-

Narratives

A two-way ANOVA was conducted with PDI group (high/ low) as the between groups variable and the narratives (delusional/ neutral) as the within-group variable and the participants likelihood ratings as the dependent variable. The data approximated a normal distribution (p = .18; see Appendix 36) and homogeneity of variance was met for all comparisons ($p > .05$).

This analysis examined average ratings of how likely the narrative was true between high and low PDI groups. The main effect of PDI group was significant ($F(1, 81) = 3.97$; $p = 0.05$; $\eta p^2 = 0.05$). The high PDI group had higher ratings than the low PDI group. There was also a significant main effect of narrative ($F(1, 81) = 205.28$; $p = 0.01$; $\eta p^2 = 0.72$) with neutral narratives rated as more likely to be true than delusional narratives. The interaction was not found to be significant ($F(1, 81) = 0.02$; $p = 0.89$; $\eta p^2 = 0.001$).

Table 8.2

Mean values (standard deviation in parenthesis) for how likely the delusional and neutral narratives were true between high and low PDI groups.

	Delusional narrative	Neutral narrative	Overall
High PDI group	2.06 (0.70)	3.63 (0.72)	3.88 (0.71)
Low PDI group	1.82 (0.73)	3.43 (0.72)	2.63 (0.73)
Overall	1.94 (0.72)	3.53 (0.72)	3.26 (0.72)

A three-way ANOVA was conducted with PDI Group (high/ low) as the between groups variable and Content (delusional/ neutral) and Perspective (self/ other referent) as the within group variables and average ratings of excitement of the delusional and neutral narratives as dependent variable. A Levene's test found that the assumption of homogeneity of variance was met for all comparisons ($p > .05$).

The main effect of PDI group was not significant ($F(1, 81) = 0.15$; $p = 0.7$; $\eta p^2 = 0.002$). There was a significant main effect of narrative ($F(1, 81) = 24.21$; $p < 0.01$; $\eta p^2 = 0.23$) with delusional narratives being rated as more exciting than neutral narratives. The main effect of perspective was also significant ($F(1, 81) = 4.08$; $p = 0.05$; $\eta p^2 = 0.05$). Narratives were rated as more exciting to others than to the self. The three-way interaction between narrative, perspective and PDI group was found to be approaching significance ($F(1, 81) = 3.03$; $p = 0.09$; $\eta p^2 = 0.04$). It seems that high PDI scorers rate delusional narratives as exciting to both themselves and others while low PDI scorers tended to rate delusional narratives as more exciting to others. No other interactions were significant for this analysis ($p \geq 0.16$).

Table 8.3

Mean values (standard deviations in parenthesis) for how exciting delusional and neutral narratives were rated to be to the self or to most other people between high and low PDI groups

	High PDI	Low PDI	Overall
Delusional/ Self-Referent	2.27 (0.73)	2.01 (0.8)	2.14 (0.77)
Delusional/ Other-Referent	2.29 (0.7)	2.23 (0.84)	2.26 (0.77)
Neutral/ Self-Referent	1.75 (0.74)	1.82 (0.75)	1.79 (0.75)
Neutral/ Other-Referent	1.84 (0.7)	1.89 (0.65)	1.87 (0.68)
Overall	2.04 (0.72)	1.99 (0.76)	2.02 (0.74)

Thematic Apperception Test

Two-way ANOVAs were conducted with PDI group (high/ low) as the between groups variable and response options (does not fit/ poor interpretation, possible but not likely interpretation, good interpretation and excellent interpretation) as the within-group variable. The total number of interpretations assigned to each response option served as the dependent variable.

The first analysis examined the total number of interpretations assigned to each response option when response options were collapsed across pictures with three and six interpretations. The data did not approximate a normal distribution for the possible and excellent options (p < .05; see Appendix 36) but did for the poor and good options (p > .05) however this was expected due to the nature of the task and ANOVA is considered robust enough to manage deviations from normality (Kim, 2013). The comparisons for the poor and good response options also met the assumption of homogeneity of variance (p = .59 and p = .42 respectively) but the possible and excellent comparisons did not (p = .04 and p = .04 respectively) so caution should be exercised in interpreting the results.

The main effect of PDI group was not significant (F (1, 81) = 0.57; p = 0.45; ηp^2 = 0.007). The main effect of response option was significant (F (1, 81) = 54.51; p < 0.01; ηp^2 = 0.40). As can be seen in Table 8.4, participants chose the 'possible but not likely' option most often and the excellent option least often. Simple contrasts showed a significant difference between the poor and unlikely response options (p < 0.01) and poor and excellent response options (p < 0.01). The interaction between PDI group and response option was not significant (F (1, 81) = 0.76; p = 0.52; ηp^2 = 0.009).

Table 8.4

Mean values (standard deviations in parenthesis) for response options between high and low PDI groups across three and six interpretations

	High PDI	Low PDI	Overall
Does not fit/ poor interpretation	7.05 (4.13)	6.95 (4.26)	7 (4.2)
Possible interpretation but not likely	9.05 (2.7)	10.02 (4.55)	9.54 (3.63)
Good interpretation	8.33 (3.65)	7.79 (3.9)	8.06 (3.78)
Excellent interpretation	2.3 (2.8)	1.49 (2.35)	1.9 (2.58)
Overall	6.68 (3.32)	6.56 (3.77)	6.62 (3.55)

The second analysis examined the total number of interpretations assigned to each response option when there were three response options. The data was not normally distributed for any of the response options ($p < .05$; see Appendix 36) however all comparisons met the assumption of homogeneity of variance ($p > .05$). The main effect of PDI group was not significant ($F(1, 81) = 0.93$; $p = 0.34$; $\eta p^2 = 0.01$). A significant main effect of response option was found ($F(1, 81) = 35.47$; $p < 0.01$; $\eta p^2 = 0.31$). The 'possible but not likely' option was chosen most often and the 'excellent' option was chosen least often. Simple contrasts revealed a significant difference between all response options ($p < 0.01$). The interaction between PDI group and response option was found to be approaching significance ($F(1, 81) = 2.42$; $p = 0.07$; $\eta p^2 = 0.03$). This appears to be due to a crossover effect; the high PDI group rated more of the interpretations as good whereas the low PDI group rated more of the interpretations as possible but not likely. This is displayed in Table 8.5.

Table 8.5

Mean values (standard deviations in parenthesis) for response options between high and low PDI groups across three interpretations

	High PDI	Low PDI	Overall
Does not fit/ poor interpretation	2.05 (1.63)	2 (1.56)	2.03 (1.6)
Possible interpretation but not likely	2.73 (1.4)	3.47 (1.88)	3.1 (1.64)
Good interpretation	3.25 (1.3)	2.74 (1.47)	3 (1.39)
Excellent interpretation	0.98 (1.19)	0.58 (0.96)	0.78 (1.08)
Overall	2.25 (1.38)	2.2 (1.47)	2.23 (1.43)

The final analysis examined the total number of interpretations assigned to each response option when there were six response options. The data was not normally distributed for any of the response options (p < .05; see Appendix 36) however all comparisons met the assumption of homogeneity of variance (p > .05).

The main effect of PDI group was not significant (F(1, 81) = 0.40; p = 0.53; ηp^2 = 0.005). The main effect of response option was significant (F(1, 81) = 48.80; p < 0.01; ηp^2 = 0.38) with the 'possible but not likely' option being chosen most often followed by the 'good', 'poor' and then 'excellent' response options (see Table 8.6).

Simple contrasts showed a significant difference between the poor and possible response options ($p < 0.01$) and the poor and excellent response options ($p < 0.01$). The interaction between the factors was not significant ($F(1, 81) = 0.27$; $p = 0.85$; $\eta p^2 = 0.003$).

Table 8.6

Mean values (standard deviations in parenthesis) for response options between high and low PDI groups across six interpretations

	High PDI	Low PDI	Overall
Does not fit/ poor interpretation	4.88 (3.05)	5.07 (3.02)	4.98 (3.04)
Possible interpretation but not likely	6.32 (2.1)	6.57 (3.13)	6.45 (2.62)
Good interpretation	5.24 (2.98)	4.88 (2.81)	5.06 (2.9)
Excellent interpretation	1.29 (1.81)	0.93 (1.69)	1.11 (1.75)
Overall	4.43 (2.49)	4.36 (2.66)	4.4 (2.58)

Snowy Pictures Task

The Snowy Pictures Task was split into four categories; the number of objects that were correctly identified, the number of objects incorrectly identified, the number of objects incorrectly detected (i.e. indicated there was an object that was not there; a false positive), and finally the participant correctly indicating that there was no object embedded. The data was not normally distributed for each category ($p < .05$; see Appendix 36 for tests of normality and non-parametric equivalent tests) however this was expected due to the type of task. The Levene's tests revealed homogeneity of variance for all comparisons ($p > .05$).

One way ANOVAs revealed no significant difference between high and low PDI groups for the number of objects incorrectly detected (false positives) (F (1, 81) = 1.02; p = 0.32). As can be seen in Table 8.7, the high PDI group incorrectly detected more objects than the low PDI group when no object had been embedded but this did not achieve significance. The number of objects incorrectly identified was also found to be non-significant (F (1, 81) = 0.54; p = 0.47). The difference between the high and the low PDI groups was not significant for the number of objects that were correctly identified (F (1, 81) = 0.23; p = 0.63) or when the participant correctly indicated that there was no object embedded (F (1, 81) = 0.22; p = 0.64).

Table 8.7

Mean values (standard deviations in parenthesis) for the Snowy Pictures Task between high and low PDI groups

	High PDI	Low PDI	Overall
Objects correctly identified	5.46 (2.16)	5.71 (2.59)	5.59 (2.38)
Objects incorrectly identified	6.41 (2.29)	6.02 (2.55)	6.22 (2.42)
Objects incorrectly detected	3.59 (2.31)	2.98 (3.11)	3.29 (2.71)
No objects indicated - correct	8.39 (2.33)	8.69 (3.4)	8.54 (2.87)
Overall	5.96 (2.27)	5.85 (2.91)	5.91 (2.59)

Coincidences

An Independent samples t-test was used to examine the difference between high and low PDI groups and the total number of coincidences reported. Exploratory data analysis indicated that the data was normally distributed ($p > .05$; see Appendix 36). Homogeneity of variance was met ($p > .05$). Results revealed a significant difference between high and low PDI groups (t (81) = - 2.56; p = 0.01) with the high PDI groups mean score being 21.59 (SD = 4.92) and low PDI groups mean score being 18.6 (SD = 5.67).

Spearman's correlation was also employed to examine if there was any relationship between total PDI score and categories of coincidences. Significant positive correlations were found between total PDI score and General Coincidences (*r* (82) = 0.25; *p* = 0.01) and Guardian Angel Experiences (*r* (82) = 0.31; *p* < 0.01). Clusters of Events (*r* = (82); 0.11; *p* = 0.16), Spontaneous Associations (*r* (82) = 0.14; *p* = 0.11), Perceptions Distant in Space (*r* = (82); 0.07; *p* = 0.26), Perceptions Distant in Time (*r* (82) = 0.05; *p* = 0.32) Unexpected solutions (*r* (82) = 0.02; *p* = 0.44) and small world experiences (r (82) = 0.05; *p* = 0.34) did not correlate significantly with PDI score.

A multiple linear regression analysis incorporating the variables; Guardian Angel Experiences, General Coincidences, Perceptions Distant in Time, Perceptions Distant in Space, Small World Experiences, Clusters of Events, Spontaneous Associations and Unexpected Solutions did not significantly predict PDI scores (F (8, 73) = 1.52; p = 0.17; R^2 = 0.05) with only 5% of the variance in PDI scores being explained by the model (Durbin Watson = 1.79). As can be seen from Table 8.8, only Guardian Angel Experiences made a significant contribution to the model.

Table 8.8

Mean (standard deviation in parenthesis), Beta, t values, p-values, partial correlations and VIF for Guardian Angel Experiences, General Coincidences, Perceptions Distant in Time, Perceptions Distant in Space, Small World Experiences, Clusters of Events, Spontaneous Associations and Unexpected Solutions.

Variable	Mean (S.D.)	Beta	*t* value	*p* value	Partial correlations	VIF
Guardian Angel Experiences	2.43 (1.12)	0.33	2.47	0.02	0.29	1.51
General Coincidences	3.02 (0.99)	0.23	1.7	0.09	0.2	1.53
Perceptions Distant in Time	2.45 (1.21)	-0.07	-0.51	0.61	-0.06	1.7
Perceptions Distant in Space	1.91 (0.96)	0.02	0.17	0.86	0.02	1.45
Small World Experiences	2.82 (0.96)	0.002	0.02	0.99	0.002	1.27
Clusters of Events	2.46 (0.95)	0.07	0.47	0.64	0.06	1.66
Spontaneous Associations	3.01 (0.95)	-0.13	-0.85	0.4	-0.1	2.1
Unexpected Solutions	2.12 (0.93)	- 0.11	-0.8	0.43	-0.09	1.67

In light of the significant bivariate correlations between General Coincidences, Guardian Angel Experiences and PDI scores a second multiple regression analysis was carried out with General Coincidences and Guardian Angel Experiences as predictors of PDI scores (Durbin Watson = 1.77). This resulted in a significant model (F (2, 79) = 5.23; p <0.01; R^2 = 0.09) with 9% of the variance in PDI scores being explained by the model. As can be seen from Table 8.9, only Guardian Angel Experiences made a significant contribution to the model.

Table 8.9

Mean (standard deviation in parenthesis), Beta, t values, p-values, partial correlations and VIF for Guardian Angel Experiences and General Coincidences

Variable	Mean (S.D.)	Beta	t value	p value	Partial correlations	VIF
Guardian Angel Experiences	2.43 (1.12)	0.25	2.21	0.03	0.24	1.15
General Coincidences	3.02 (0.99)	0.16	1.42	0.16	0.16	1.15

Finally, two-way Chi-Square tests were used to investigate if there were any associations between PDI group and what participants thought coincidences were due to. There was a significant association between PDI group and extra sensorial perception (χ^2 (df = 2) = 8.71; p = 0.01). This seems to be because high PDI scorers attributed coincidences to extra sensorial perception compared to low PDI scorers. In contrast, low PDI scorers chose the 'don't know' or 'no' option more often than high PDI scorers when asked if they thought coincidences were due to extra sensorial perception. None of the other associations were found to be significant for this analysis ($p \geq 0.15$).

Discussion

Consistent with Chapters 3, 4 and 5, the high PDI group gave higher ratings than the low PDI group for how likely/ true they rated narratives to be. Higher ratings were given to the neutral narratives as opposed to delusional narratives meaning that the prediction that high PDI scorers would rate delusional narratives as more likely to be true was only partially supported (see also LaRocco & Warman, 2009). Nonetheless, these findings demonstrate a liberal acceptance reasoning style insofar as a lowered threshold for plausibility and a general 'willingness to accept' is displayed for both delusional and neutral narratives in those high in delusional ideation.

When participants were asked how exciting they found the narratives, delusional narratives were rated as more exciting by both groups. These may offer greater excitement, particularly to those who engage in delusional thinking. This can potentially be seen as a mechanism by which stimuli are accepted by high PDI scorers – if there is greater excitement in the stimulus, the more likely it is to surpass this lowered threshold for plausibility.

Consistent with Moritz and Woodward (2004), plausibility ratings of various interpretations for pictures from the Thematic Apperception Test were used to look for differences between participants high and low in delusional ideation. This has previously been employed to examine liberal acceptance in a clinical sample and it is therefore important to see if the same trends can be detected in a subclinical sample, consistent with the continuum theory of psychosis (van Os et al., 2009).

When participants viewed pictures with both three and six interpretations, the ratings between the high and low PDI groups were similar and no significant differences emerged. When participants viewed pictures with six interpretations (as opposed to both three and six interpretations collapsed together), again, the plausibility ratings were similar between the groups. However, when participants rated the plausibility of three interpretations, the interaction between PDI group and plausibility ratings of the interpretations was found to be approaching significance. This seems to be because of a crossover effect; participants in the low PDI group rated more of the interpretations as 'possible but not likely', whereas participants in the high PDI group rated more of the interpretations as 'good'. This is consistent with a liberal acceptance reasoning style however this effect was only evident when there were three interpretations. Moritz and Woodward (2004) have put forward that when interpreting events, some explanations are accepted as plausible by patients with schizophrenia whereas healthy participants may not accept the same explanations and these are subsequently ruled out more quickly. In the present experiment, it seems that pictures with three interpretations were able to detect these differences in that, participants high in delusion ideation considered more of these explanations as good whereas participants low in delusional ideation rated these as unlikely. This could be because there were less options to choose from, with a greater number of options, participants in both groups tended to rate the interpretations similarly. This is curious given that more options should lead to greater ambivalence (Moritz & Woodward, 2004) however, it could be the case, as with the beads task, that when options are severely limited, certain interpretations ‘stand out’ as the most likely option and could explain these differences found in the present study.

In Chapter 4, high PDI scorers, compared to low PDI scorers, detected more objects that were not present in visual ‘noise’ indicating a ‘loose’ or disinhibited cognitive style. This is a potential mechanism that may explain *why* liberal acceptance emerges, detecting patterns that do not exist or making causal connections between random events (apophenia) may lead to events appearing more plausible to those high in delusional ideation. In the current Chapter, high PDI scorers did report detecting more objects that were not present and incorrectly identified more objects in visual noise however these differences did not achieve significance. Engaging in apophenia has led some authors to argue that this enables the individual to make close associations between random events, which in turn may account for the emergence of magical and paranormal, as well as delusional beliefs (Farias et al., 2005).

In support of this notion, high PDI scorers reported experiencing significantly more general coincidences than low PDI scorers. Additionally, a positive correlation between PDI score and general coincidences and guardian angel experiences was found. Some specific types of coincidences (Perceptions Distant in Time, Perceptions Distant in Space, Small World Experiences, Clusters of Events, Spontaneous Associations and Unexpected Solutions) however did not significantly predict delusional ideation, only general coincidences and guardian angel experiences alone were found to be significant predictors. This may contribute to the formation of delusional beliefs because seemingly objective connections (like not arriving in time at a job interview and then discovering that it has been for the best, because a much better chance, which we would otherwise have missed, turns up) seem unexplained by reason and science (Bressan, 2002) and may act as a way to reinforce such beliefs. Indeed, this mechanism could explain why high PDI scorers may accept an explanation as plausible while low PDI scorers would reject the same explanation.

It is also of interest that the coincidences that were experienced most often by people who engage in delusional thinking were general ones and guardian angel experiences. In relation to guardian angel experiences, previous research has found that spirituality and religiosity can have a positive impact on patients with psychosis and provides a mechanism which helps patients to deal with positive symptoms of psychosis, such as delusions and hallucinations (Mohr Brandt, Borras, Gillieron & Huguelet, 2006). This seems to be because, for some patients, religious or spiritual concepts offer an explanation for their illness regardless of whether this is a positive or a negative explanation and it gives some meaning, which in turn, helps patients to cope with the symptoms of their illness (Mohr et al., 2006). In a subclinical population, coincidental experiences, such as the feeling of being watched over by a guardian angel, may provide a good explanation for a random event that may appear to have no rational explanation. Additionally, when participants in the present study were asked what they thought coincidences were due to, little difference emerged between the groups except for extra sensorial perception which resulted in a significant difference between high and low PDI scorers. Extra sensory perception generally refers to perception occurring independently of sight, hearing, or other sensory processes - sometimes known as the sixth sense. While high PDI scorers indicated that they thought coincidences were due to extra sensory perception, low PDI scorers chose the 'don't know' or 'no' option more often for this. As Rogers (2015) points out, when extra sensorial perception is endorsed by paranormal believers, it is often based on some remarkable and subjectively meaningful coincidental experience (Thalbourne, 2006) and has led to claims that proneness to errors in probabilistic reasoning may be responsible for this. Errors in probabilistic reasoning have also been consistently demonstrated in people high in delusional ideation (e.g. Garety & Freeman, 1999) and could potentially explain the misattribution of these meaningful coincidental events to a cause beyond the realms of science, such as having a guardian angel.

In summary, participants high in delusional ideation rated narratives as more likely to be true than participants low in delusional ideation. This suggests a potential mechanism for why participants high in delusional ideation may liberally accept. When rating various interpretations for ambiguous pictures, high PDI scorers rated more of the interpretations as 'good' whereas low PDI scorers rated more of the interpretations as 'possible but not likely' when there were three interpretations. Finally, coincidental experiences play a part in why people high in delusional ideation liberally accept. Random events are often interpreted as having a causal explanation.

Chapter IX

General Discussion

Aims of the thesis and summary of key findings

This thesis has found that participants high in delusional ideation demonstrate a more liberal reasoning style by seeing plausibility and salience where others do not in delusional and neutral content. This thesis has also found that factors that are important for the liberal acceptance account appear to be excitement about the stimuli, emotional creativity and perceptual and non-perceptual apophenia. The aim of this thesis was to make two new contributions to the literature. The first was to test whether liberal acceptance could be demonstrated in non-clinical, delusion-prone participants as opposed to patients. Secondly, this thesis aimed to explore previously untested questions as to why people with delusional ideas exhibit a liberal reasoning style. This has been achieved by exploring factors such as, bizarreness, excitement, personality, creativity and apophenia in relation to delusional beliefs.

It is evident in this thesis that excitement about delusional stimuli is an important factor that has not previously been considered in the published literature and provides a mechanism by which stimuli may be accepted as plausible or salient. In addition, apophenia has not previously been investigated in delusional beliefs. This is important since the evidence from this thesis suggests that apophenia has an effect on those that hold delusional beliefs in the subclinical population in that patterns are detected where none exist and more causal connections are made where cause and effect cannot necessarily be established. This may lead to unfounded, delusional beliefs potentially through misattributing meaning to random events/ occurrences. Furthermore, this may maintain aberrant beliefs over time if a liberal reasoning style is adopted. This thesis has shown that liberal acceptance is evident in a non-clinical population and has explored a number of variables that contribute to a liberal acceptance reasoning style. A summary of the findings from the experiments that have been conducted will be given before moving on to a discussion of these findings in relation to liberal acceptance.

Discussion of findings

Throughout this thesis, most notably it has been found that, there was a tendency for those high in delusional ideation to rate stimuli with both delusional and neutral themes as more likely to be true compared to those low in delusional ideation (Chapters 3-5 & Chapter 8). In addition, there was evidence that high PDI scorers rated stimuli as more likely to happen although this was rated as more likely to happen to others than to themselves (Chapter 3). It was consistently found that stimuli with delusional themes were rated as more exciting than stimuli with neutral themes by high PDI scorers, highlighting a potential mechanism for why narratives with delusional and neutral themes are more likely to be accepted by those high in delusional ideation in comparison to those low in delusional ideation (Chapter 2, 5 & 8). Sensation seeking did not provide an explanation for finding excitement in delusional stimuli however, cognitive looseness did explain the relationship between PDI score and finding scenarios more exciting (Chapter 3).

Furthermore, apophenia (both perceptual and non-perceptual) appears to play a central role in why participants high in delusional ideation liberally accept. Embedded objects were reported in visual 'noise' where no object had been embedded (Chapter 4). Consistent with this, high PDI scorers also tended to report experiencing more coincidences than low PDI scorers (Chapter 5 & 8). This thesis has been successful in highlighting whether (and with what types of stimuli) participants high in delusional ideation liberally accept and in identifying potential factors that underpin this acceptance. This was also investigated in light of studies with clinical patients (Chapter 6 & 7). In addition, this thesis has extended the definition of liberal acceptance to include parameters where stimuli are rated more highly on plausibility but also on other parameters such as the salience of stimuli. These findings will now be discussed in light of relevant literature.

Do people high in delusional ideation liberally accept?

LaRocco and Warman (2009) first compared participants high and low in delusional ideation and asked them to rate whether narratives with delusional and neutral themes were more likely to be true. They found that those high in delusional ideation rated delusional narratives as more likely to be true compared to those low in delusional ideation and suggested that there was something about delusional material that affects reasoning in a unique way in those high in delusional ideation. This has been interpreted in this thesis as being synonymous with liberal acceptance. It makes intuitive sense to interpret LaRocco and Warman's (2009) findings in this way – if participants rate narratives with delusional content as more likely to be true, they therefore appear to be biased to accept delusional narratives as plausible. This is consistent with the way Moritz and Woodward (2004) theorised that patients with schizophrenia displayed a lowered threshold for acceptance and thus, accepted information as plausible - information that would either be rejected or rated lowly by others. Liberal acceptance has been demonstrated consistently in patients with schizophrenia (Moritz & Woodward, 2004; Moritz, et al., 2006; Moritz, et al., 2008; Moritz, et al., 2007). Although Moritz and colleagues did not discriminate between currently delusional/ non-delusional schizophrenic patients, it was assumed that liberal acceptance provides a mechanism by which information is initially accepted as plausible and over time becomes a sustained and potentially delusional belief.

A recent meta-analysis suggests that reasoning biases thought to contribute to belief formation, including liberal acceptance, are not simply features of schizophrenia but fluctuate with current delusional state; being elevated when delusions are worse and lower when delusions subside (McLean, et al., 2017). This is of utmost importance since it implies that reasoning biases contribute causally to delusions. Furthermore, people with psychiatric illnesses without delusions displayed the same level of liberal acceptance (and other reasoning biases, such as a bias against disconfirmatory evidence, bias against confirmatory evidence and a jump to conclusions bias) as healthy control groups, meaning that having a psychiatric illness without delusions does not account for the reasoning biases seen in patients with delusions (McLean et al., 2017).

In the present thesis, I have demonstrated that high PDI scorers have a lowered threshold for plausibility or salience (particularly in relation to how exciting or likely the narratives are) supporting a continuum model of psychosis – particularly in relation to positive symptoms such as delusions. Participants rated narratives with delusional and neutral content as more likely to be true than participants low in delusional ideation; significantly so in Chapters 3, 5, and 8. This was mostly relevant to neutral narratives rather than delusional ones and suggests that liberal acceptance is more pervasive and generalised, in that, it is not only delusional materials where we see this effect, it is also in relation to neutral material. Having said that, in Chapter 4, there was found to be a significant interaction between high and low PDI scorers and delusional and neutral narratives, with high PDI scorers rating delusional narratives as more likely to be true and low PDI scorers rating neutral narratives as more likely to be true, resulting in a significant crossover effect. Although it may be seen as beneficial to exclude the use of materials containing delusional themes to avoid tautological effects (Dudley & Over, 2003), in the real world, implausible, even delusional themes may be encountered and either accepted or rejected based on subjective ratings of plausibility.

Moritz and Woodward's (2004) findings, using the Thematic Apperception Test, indicated that liberal acceptance was more pronounced when scenarios were absurd or less likely and that these were usually discounted either through 'common sense' or prior knowledge. Furthermore, when a situation is ambiguous in nature and has more than one clear alternative, greater ambivalence means that several alternatives may be entertained as plausible and cross the decision threshold (Moritz et al., 2007). In the present thesis when participants rated narratives in terms of likelihood of being true (Chapters 3-5 & 8), it seems that more of the narratives (both delusional and neutral) surpassed a lowered threshold of acceptance in participants in the high PDI group but not the low PDI group and thus, higher ratings of plausibility were evidenced.

In Chapter 6 and Chapter 8, the aim was to investigate liberal acceptance using materials similar to that of Moritz and Woodward (2004). A similar trend was found in a subclinical sample to that of Moritz and Woodward (2004) but these differences were simply too subtle to achieve significance. Low PDI scorers rated more of the interpretations for pictures from the Thematic Apperception Test as poor while high PDI scorers more often rated these as either possible, good or excellent. This would imply that when interpreting events in the real world, information may be taken as plausible by people high in delusional ideation that may not be accepted as plausible by people lower on the continuum in terms of delusional ideation. The effect, however is much more subtle in the current experiments, although still in the expected direction, demonstrating a strong likelihood of a liberal acceptance bias in a non-clinical sample.

In Chapter 7, using materials from Moritz et al. (2006) to examine liberal acceptance did not distinguish between participants high and low in delusional ideation. Using a task similar to 'Who wants to be a Millionaire', participants answered general knowledge questions with four possible answers and additionally provided a probability estimate for each answer. This novel task allows for the point to be determined of when a probability estimate translates into either a decision or a rejection. It has been shown previously (Moritz et al., 2006) that patients with schizophrenia tended to make more incorrect decisions and rejections as well as base these on lower or higher probability estimates respectively. In the current thesis, high PDI scorers did not make more incorrect decisions, endorse decisions in light of low probability estimates or reject answers in the face of high probability estimates in comparison to low PDI scorers, as patients with schizophrenia and healthy participants did in the original study. While this provides further evidence to support the notion that deluded participants performed similar to controls on probability estimates (Dudley et al., 1997a) and distinguishes between patients with schizophrenia and healthy controls (Moritz et al., 2006), it does not appear to be subtle enough to detect differences in a subclinical sample. Participants performed similarly across both probability estimates and selecting correct and incorrect answers regardless of being in a high or low delusional ideation group. This would imply that a stricter acceptance threshold had potentially been employed when making decisions and rejections, making it less likely that trends would emerge consistent with the liberal acceptance account. None of the participants demonstrated high scores in delusional ideation and the median that was utilised to form the groups was exceptionally low; hence, this may explain why differences failed to emerge in Chapter 7 – performance between the groups remained similar throughout. The original study upon which this was based did not distinguish between delusional and non-delusional patients with schizophrenia (Moritz et al., 2006). Therefore, findings remain tentative in terms of whether this relates to current delusional state, as McLean et al. (2017) points out.

The first aim of the above experiments was to test whether liberal acceptance could be demonstrated in a subclinical sample. It seems that while the effects are subtle, differences between the groups have been established when reasoning was examined. The second aim was to explore and test a number of different variables for why participants high in delusional ideation may exhibit a liberal acceptance bias.

Why do people high in delusional ideation liberally accept?

Since participants high in delusional ideation rated delusional narratives as more likely to be true (LaRocco & Warman, 2009), it was theorised that this may be because delusional material may be seen as less bizarre and disturbing. There is evidence to suggest that many individuals find their delusional ideas disturbing (e.g. Stanton & David, 2000) and bizarreness has not been examined previously in the literature. Despite this, ratings of how bizarre and disturbing narratives were did not differentiate between participants high and low in delusional ideation in Chapter 2 or 3. Nonetheless, when participants were asked how exciting they found narratives, high PDI scorers gave significantly higher ratings in Chapters 2, 5 and 8 (Chapter 3 was approaching significance) than low PDI scorers. Furthermore, delusional narratives were rated as more exciting than neutral narratives. Unusual, divergent beliefs appear to offer a greater excitement than the mundane (Kumar, et al., 1993; Zuckerman, 1979). This finding is also consistent with research highlighting arousal abnormalities in delusional patients (Mujica-Parodi, et al., 2002) and delusion-prone participants (Kéri et al., 2011).

Kapur (2003) posited that the root of schizophrenia lies in aberrant salience whereby excessive salience is given to external stimuli and internal representations. Recent research has provided support for this position. So et al. (2017) examined the effect of emotional disturbances and aberrant salience on persecutory delusions and found that persecutory delusions were exacerbated by both negative emotions and aberrant salience but that aberrant salience provided both direct and indirect pathways to persecutory delusions. Additionally, Larivière et al. (2017) found that delusional patients endorsed generic statements as self referent; in other words, these generic statements were given greater salience or personal significance. The above findings of participants high in delusional ideation finding excitement in delusional stimuli is in line with the evidence suggesting that aberrant salience is implicated. It suggests that delusional narratives hold particular salience for those high in delusional ideation and are thus rated as more exciting.

These findings provide new evidence not only that a liberal acceptance bias is evident in delusion-prone individuals, but also that inflated estimates of likelihood and feelings of excitement may be reasons why such individuals have a more liberal threshold of acceptance. These findings provided a rationale to explore the concept of sensation seeking and whether this excitement was due to participants high in delusional ideation being sensation seekers. This however was not demonstrated and it implies that there is something specific about the delusional stimuli that affects high PDI scorers' excitement and that it was not a general tendency to seek excitement in all other areas of life but more suggestive of a general bias to perceive abnormal salience in stimuli and experiences where others do not.

Although previous studies have found a relationship between personality variables and delusional ideation (Ross, et al., 2002; Larøi, et al. 2005), no such relationship was found when this was investigated in Chapter 3. Moreover, there is evidence to suggest that schizotypal personality traits are associated with creativity (see Nettle, 2006). Schuldberg (1988; 1990; 2000) has shown that self-report measures of creativity and scales to measure liability to psychiatric symptoms are correlated, particularly measures relating to the positive symptoms of psychotic illness (i.e. delusions and hallucinations). Both creativity and the psychosis continuum are related to cognition and thus it was theorised that creativity may be a factor in why delusion-prone individuals see plausibility where others do not. In Chapter 3, it was found that attempts to examine creativity in relation to delusional ideation resulted in emotional creativity playing an important part but not ratings of self-reported creative personality. One of the key aspects of emotional creativity is the ability to think in novel ways, particularly in comparison to group norms (Averill, 1999; Humphreys, et al., 2008). Averill (1999) found that those who score highly on the General Mysticism Scale (Hood, 1975) measuring unusual experiences had greater emotional creativity - this also appears to extend to those who hold unusual beliefs, as seen in Chapters 3 and 4. Furthermore, emotional creativity has previously been shown to be positively associated with fantasy proneness (Fuchs et al., 2007). In addition, those who score highly on scales measuring positive psychotic symptoms have been found to make more semantic associations (Mohr, et al., 2001). In Chapter 3, it was found that the Remote Associate Test mediated the association between PDI score and ratings of excitement of narratives. In other words, lower scores on the Remote Associate Test explain why high PDI scorers rated the scenarios as more exciting. Hence, low scores on the Remote Associate Test would suggest 'cognitive looseness' in high PDI scorers and cognitive inhibition in low PDI scorers. This is potentially because high PDI scorers perform less well when attempting to narrow the options down to a single answer (cf. Young & Bentall, 1995).

The idea of cognitive 'looseness' or a 'looseness of associations' (Gianotti et al., 2001) as an underpinning factor of delusional ideation was investigated further in Chapter 4 and 5. Farias et al. (2005) found that schizotypy was associated with participants finding complex types of visual patterns (static or moving people, animals, objects and landscapes etc.) in visual displays of random dots. Fyfe and colleagues (2008) made the suggestion that apophenia (the tendency to perceive meaningful patterns and causal connections where none exist; Fyfe et al., 2008) may be a contributing factor to the formation of paranormal as well as delusional beliefs. Indeed, this effect was also replicated in Chapter 4 and participants high in delusional ideation reported seeing significantly more objects in visual 'noise' than participants low in delusional ideation. This was reinforced further in Chapter 5, when high PDI scorers reported experiencing significantly more coincidences in

Chapters 5 and 8. Thus cognitive looseness is a potential mechanism that may explain why liberal acceptance emerges: detecting patterns that do not exist in perceptual experiences or making causal connections between random events such as coincidences (apophenia) may lead to events appearing more plausible or salient to those high in delusional ideation and thus accepted more easily. Brugger (1997) has put forward that believers in the paranormal have a lower 'threshold of causal attribution' and a consequence of this is the need to make more causal connections between random events. Therefore, in the event that a natural cause cannot be found, a paranormal or delusional explanation may seem fitting since it will need to be given causal meaning (Bressan, 2002). Blanco, Barberia and Matute (2015) provided additional support for this by demonstrating that paranormal believers were biased to expose themselves to cause-present (as opposed to cause-absent) cases and that this in turn strengthens the illusion of causality. Paranormal beliefs however did not affect the participant's ability to detect causal relationships that did exist (Blanco et al., 2015). Furthermore, participants high in delusional ideation appear to attribute coincidences to destiny, divine intervention and everything being connected to everything else in the universe in Chapter 5, whereas participants in the low PDI group attributed coincidences to pure chance. In addition, it could be argued that the causal connections made from coincidental experiences by high PDI scorers and the multiple explanations that are accepted for the occurrence of coincidences (i.e. destiny, divine intervention etc.) are entertained as plausible due to a liberal reasoning style.

In summary, excitement about the stimulus combined with emotional creativity and the ability to make causal connections between random events and see patterns where none exist in both perceptual and non-perceptual forms provide a persuasive explanation for why participants high in delusional ideation display a liberal reasoning style.

Limitations and Future Directions

There are several limitations of this thesis that will be highlighted below while examining potential areas for future research.

While this thesis has examined a number of different variables in relation to liberal acceptance and underpinning factors of this, it should be acknowledged that in the above empirical chapters, as well as the sample being drawn from a student population, the majority of participants in each study were predominantly female. Although previous research examining the properties of the Peters et al. Delusions Inventory has shown no sex differences on the measure (Peters et al., 2004) other research examining the incidence of schizophrenia (Falkenburg & Tracy, 2012) and first-episode psychosis (Ochoa, Usall, Cobo, Labad & Kulkarni, 2012) has found that males have a higher incidence rate. It has also been found that the age of onset differs between the sexes (Falkenburg & Tracy, 2012) with the onset in males being between the ages of 18-25 and for females, between the ages of 25-35. This means that results may have differed if the distribution of males and females had been more balanced. This should certainly be considered in future studies examining subclinical delusional ideation. Furthermore, none of the participants displayed exceptionally high levels of delusional ideation and the median scores used to form the high and low groups were relatively low in comparison to other studies of this nature (e.g. LaRocco & Warman, 2009). Despite this, it is compelling that so many noteworthy differences were found between participants classified as high or low in delusional ideation.

With regards to the methods employed in this thesis, there have been precautions given about the use of a median split; these have also been highlighted in the literature by MacCallum, Zhang, Preacher, and Rucker (2002). These primarily concentrate on people being assigned to the same group on the basis of falling above or below the median. It is argued that essentially, people placed in a high or a low group will not necessarily be the same, even though they are treated as such in any analysis. It is also noted in the same article that effect sizes may be reduced and there may be an increase in the likelihood of spurious effects. Along the same lines as this limitation, previous studies have aimed to measure delusional ideation along a continuum yet it is not uncommon in the literature on delusional ideation and reasoning to employ the same categorical approach as that employed in the experiments in this thesis (e.g. LaRocco & Warman, 2001; Galbraith et al., 2008; 2010). To address this, further analyses were carried out and can be found in Appendix 35. These analyses go some way to support the results in the empirical chapters of this thesis. In almost all cases where a median split has been employed and significant differences have been found between high and low PDI groups, the dependent variable could be predicted by total PDI scores, demonstrating that categorical and continuous independent variables ultimately led to similar outcomes.

In previous research on reasoning in delusional patients (McGuire et al., 2001) and delusion-prone non-patients (LaRocco & Warman, 2009) authors have suggested that participants would be more familiar with delusional material and thus have given higher ratings of likelihood for such material. Although familiarity was found to influence probability estimates in patients with delusions (McGuire et al., 2001), this was not the case with people high in delusional ideation in LaRocco and Warman’s (2009) study. Nonetheless, this has not been measured in the experiments in this thesis and future studies should consider including a measure of familiarity with materials to see the effect this may have on reasoning about stimuli with delusional content. In addition, although the narratives in Chapters 2-5 and Chapter 8 contained delusional content that was consistent with various delusional themes (grandiose, persecutory, reference, bizarre and Schneiderian delusions e.g. control, thought broadcasting, insertion and withdrawal) no attempt was made to explore the effect of any one particular theme further. For example, persecutory delusions are thought to be more common than grandiose delusions (Freeman, 2007); there were also differences found between grandiose and persecutory narratives in LaRocco and Warman’s (2009) study, therefore, different themes may influence likelihood ratings. This is in addition to the notion of familiarity influencing estimates of likelihood in clinical patients with delusions (McGuire et al., 2001). Future studies should examine the effect that different delusional themes have on reasoning and whether one particular type of delusion would result in inflated estimates of likelihood or greater excitement, for example.

Although self reference and the effect of emotionally salient material have been considered in this thesis, the effect of emotions on reasoning could have been examined in more depth as this may have had an effect on reasoning. For example, emotionally salient material appeared to exaggerate the JTC bias and lead to more errors in reasoning in one study (Dudley, et al., 1997b) and thus should be given closer attention in future research.

Implications

Considering the implications of the above research, the data suggest that people who engage in delusional thinking may be more prone to develop delusional beliefs due to a liberal reasoning style and underpinning factors of this. Research suggests that 1-3% of the non-clinical population have delusions with the same severity as patients with clinical delusions. Around 5-6% of the non-clinical population have a delusion with less severity but still experience social and emotional difficulties as a consequence of this. A further 10-15% of the non-clinical population have regular delusional ideation (Freeman, 2006). This provides convincing evidence of the link between these experiences of clinical delusions, delusions and delusional ideation and reinforces the rationale for studying people who engage in delusional ideation as a means of making inferences regarding the clinical population (Freeman, 2006).

A recent meta-analysis has demonstrated that liberal acceptance may combine with other biases (such as biases against disconfirmatory evidence, biases against confirmatory evidence and jumping to conclusions) to form a single 'evidence integration' cognitive process (McLean et al., 2017). It is therefore of utmost importance that cognitive therapies are developed to address reasoning biases associated with delusions. Ultimately, findings from the above research in this thesis contribute to this process by highlighting underpinning factors of the liberal acceptance bias in a subclinical population.

Metacognitive training for psychosis (Moritz et al., 2007) is a fairly new therapy aimed at reducing reasoning biases in clinical delusions and has shown promising results in reducing delusional severity in schizophrenia patients (Eichner & Berna, 2016). The aim of this therapy is to raise patients' awareness of cognitive errors and how to think critically about these while learning how to spot and avoid them. The research that has been carried out in this thesis is important to interventions such as metacognitive training since it provides new evidence of the different kinds of cognitive biases that such interventions could potentially target.

Thesis conclusions

To conclude, the current thesis contributes to the literature by demonstrating that participants high in delusional ideation display reasoning biases similar to patients with clinical delusions and by examining variables that explain why participants demonstrate these reasoning biases.

This thesis has found that participants high in delusional ideation demonstrated a more liberal reasoning style by seeing plausibility and salience where others did not in delusional and neutral content. This thesis has also found that factors that are important for the liberal acceptance account appear to be excitement about the stimuli, emotional creativity and perceptual and non-perceptual apophenia. These factors offer explanations for why participants high in delusional ideation liberally accept. Current research that examines reasoning in delusions, including this thesis, represents a step forward in supporting patients with delusions.

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Appendices

Appendix 1 – Information Sheet

Subclinical delusional ideation and likelihood ratings of delusional and neutral narratives

Information Sheet

Delusional Ideation and Reasoning

You are invited to participate in a study of beliefs and reasoning. The purpose of this study is to investigate if strong beliefs are related to certain thinking styles.

The study is being conducted by Claire Jones (c.l.jones@wlv.ac.uk) and Dr Niall Galbraith (n.galbraith@wlv.ac.uk) in the Department of Psychology at the University of Wolverhampton.

If you decide to participate you will be required to complete a demographics form, a questionnaire and to complete a series of narratives. The first questionnaire measures beliefs and vivid mental experiences. There are no right or wrong answers and you should answer the questions as honestly as you can. The reasoning task requires you to read nine short narratives and assess them on various parameters.

Any information gathered in this study will remain anonymous. No individual will be identified in any publication of results. All data will be locked in a cabinet in the supervisor's office for a period of five years upon which it will be destroyed. Only the investigator and the supervisor will have access to this information. You are also reminded that you are free to withdraw at any point during the study without giving a reason and without consequence.

A summary of the results of this data will be made available to you in the following week.

If you consent to participate in this study please sign the Consent Form provided and return to the investigator.

Thank you for your participation.

Claire Jones, Dr Niall Galbraith.

Appendix 2 – Consent form

Consent Form

In signing this form I agree that I have read and understood the information sheet provided.

I have had time to ask questions of the researcher.

I understand that my responses are anonymous

I understand that I am free to withdraw during this study at any time without giving a reason and without consequence.

I consent to take part in this study.

Name………………….

Signature………………

Date……………………

Appendix 3 – Demographics form

Participant information

Please indicate the following:

Your sex:

Your age:

Appendix 4 – Peters et al., Delusions Inventory (1996)

Peters et al. Delusions Inventory (PDI: Peters et al., 1996)

Redacted

Appendix 5 – Delusional Narratives

Please read the following narratives and circle the appropriate answer accordingly.

Redacted

How likely is it that this narrative is true?	0% 1	2	50% 3	4	100% 5
How bizarre do you find this narrative?	Not at all bizarre 1	2	3	4	Extremely bizarre 5
How likely is it that this could happen to you?	Extremely unlikely 1	2	3	4	Extremely likely 5
How likely is it that this could happen to someone you know?	Extremely unlikely 1	2	3	4	Extremely likely 5
How disturbing do you find this narrative?	Not at all disturbing 1	2	3	4	Extremely disturbing 5
How bizarre would the narrative be to most other people?	Not at all bizarre 1	2	3	4	Extremely bizarre 5
How exciting do you find this narrative?	Not at all exciting 1	2	3	4	Extremely exciting 5
How disturbing would the narrative be to most other people?	Not at all disturbing 1	2	3	4	Extremely disturbing 5
How exciting would the narrative be to most other people?	Not at all exciting 1	2	3	4	Extremely exciting 5

Redacted

3.

How likely is it that this narrative is true?	0% 1	2	50% 3	4	100% 5
How bizarre do you find this narrative?	Not at all bizarre 1	2	3	4	Extremely bizarre 5
How likely is it that this could happen to you?	Extremely unlikely 1	2	3	4	Extremely likely 5
How likely is it that this could happen to someone you know?	Extremely unlikely 1	2	3	4	Extremely likely 5
How disturbing do you find this narrative?	Not at all disturbing 1	2	3	4	Extremely disturbing 5
How bizarre would the narrative be to most other people?	Not at all bizarre 1	2	3	4	Extremely bizarre 5
How exciting do you find this narrative?	Not at all exciting 1	2	3	4	Extremely exciting 5
How disturbing would the narrative be to most other people?	Not at all disturbing 1	2	3	4	Extremely disturbing 5
How exciting would the narrative be to most other people?	Not at all exciting 1	2	3	4	Extremely exciting 5

Redacted

5.

How likely is it that this narrative is true?	0% 1	2	50% 3	4	100% 5
How bizarre do you find this narrative?	Not at all bizarre 1	2	3	4	Extremely bizarre 5
How likely is it that this could happen to you?	Extremely unlikely 1	2	3	4	Extremely likely 5
How likely is it that this could happen to someone you know?	Extremely unlikely 1	2	3	4	Extremely likely 5
How disturbing do you find this narrative?	Not at all disturbing 1	2	3	4	Extremely disturbing 5
How bizarre would the narrative be to most other people?	Not at all bizarre 1	2	3	4	Extremely bizarre 5
How exciting do you find this narrative?	Not at all exciting 1	2	3	4	Extremely exciting 5
How disturbing would the narrative be to most other people?	Not at all disturbing 1	2	3	4	Extremely disturbing 5
How exciting would the narrative be to most other people?	Not at all exciting 1	2	3	4	Extremely exciting 5

Redacted

7.

How likely is it that this narrative is true?	0% 1	2	50% 3	4	100% 5
How bizarre do you find this narrative?	Not at all bizarre 1	2	3	4	Extremely bizarre 5
How likely is it that this could happen to you?	Extremely unlikely 1	2	3	4	Extremely likely 5
How likely is it that this could happen to someone you know?	Extremely unlikely 1	2	3	4	Extremely likely 5
How disturbing do you find this narrative?	Not at all disturbing 1	2	3	4	Extremely disturbing 5
How bizarre would the narrative be to most other people?	Not at all bizarre 1	2	3	4	Extremely bizarre 5
How exciting do you find this narrative?	Not at all exciting 1	2	3	4	Extremely exciting 5
How disturbing would the narrative be to most other people?	Not at all disturbing 1	2	3	4	Extremely disturbing 5
How exciting would the narrative be to most other people?	Not at all exciting 1	2	3	4	Extremely exciting 5

Redacted

9.

How likely is it that this narrative is true?	0% 1	2	50% 3	4	100% 5
How bizarre do you find this narrative?	Not at all bizarre 1	2	3	4	Extremely bizarre 5
How likely is it that this could happen to you?	Extremely unlikely 1	2	3	4	Extremely likely 5
How likely is it that this could happen to someone you know?	Extremely unlikely 1	2	3	4	Extremely likely 5
How disturbing do you find this narrative?	Not at all disturbing 1	2	3	4	Extremely disturbing 5
How bizarre would the narrative be to most other people?	Not at all bizarre 1	2	3	4	Extremely bizarre 5
How exciting do you find this narrative?	Not at all exciting 1	2	3	4	Extremely exciting 5
How disturbing would the narrative be to most other people?	Not at all disturbing 1	2	3	4	Extremely disturbing 5
How exciting would the narrative be to most other people?	Not at all exciting 1	2	3	4	Extremely exciting 5

Appendix 6 – Neutral Narratives

2. My friends had invited me to a party at their house. At the party, I began to play a game with my friends. We had a bag of a hundred marshmallows. A quarter of the marshmallows were pink and the rest of the marshmallows were white. The game was that we all took turns to see if we could pick out a certain colour marshmallow. I started the game and my friends asked me if I could pick out a white marshmallow. I said I was sure I could pick out a white marshmallow without looking.

How likely is it that this narrative is true?	0% 1	2	50% 3	4	100% 5
How bizarre do you find this narrative?	Not at all bizarre 1	2	3	4	Extremely bizarre 5
How likely is it that this could happen to you?	Extremely unlikely 1	2	3	4	Extremely likely 5
How likely is it that this could happen to someone you know?	Extremely unlikely 1	2	3	4	Extremely likely 5
How disturbing do you find this narrative?	Not at all disturbing 1	2	3	4	Extremely disturbing 5
How bizarre would the narrative be to most other people?	Not at all bizarre 1	2	3	4	Extremely bizarre 5
How exciting do you find this narrative?	Not at all exciting 1	2	3	4	Extremely exciting 5
How disturbing would the narrative be to most other people?	Not at all disturbing 1	2	3	4	Extremely disturbing 5
How exciting would the narrative be to most other people?	Not at all exciting 1	2	3	4	Extremely exciting 5

4. My friend asked me if we could go to the Christmas fete. When we got there, there were a number of stalls. The stalls had been beautifully decorated and gave a warm, exciting feeling about Christmas. On one of the stalls the owner had a jar that was half full of sweets. The stall owner told us that there were a hundred sweets left in the jar. Half of them were yellow and the rest of them were red. If a person could choose a red sweet from the jar without looking they would win a prize. I said I could choose a red sweet from the jar without looking.

How likely is it that this narrative is true?	0% 1	2	50% 3	4	100% 5
How bizarre do you find this narrative?	Not at all bizarre 1	2	3	4	Extremely bizarre 5
How likely is it that this could happen to you?	Extremely unlikely 1	2	3	4	Extremely likely 5
How likely is it that this could happen to someone you know?	Extremely unlikely 1	2	3	4	Extremely likely 5
How disturbing do you find this narrative?	Not at all disturbing 1	2	3	4	Extremely disturbing 5
How bizarre would the narrative be to most other people?	Not at all bizarre 1	2	3	4	Extremely bizarre 5
How exciting do you find this narrative?	Not at all exciting 1	2	3	4	Extremely exciting 5
How disturbing would the narrative be to most other people?	Not at all disturbing 1	2	3	4	Extremely disturbing 5
How exciting would the narrative be to most other people?	Not at all exciting 1	2	3	4	Extremely exciting 5

6. A colleague of mine had been looking for a used car. I suggested that she should go to have a look at a car auction because cars are usually quite inexpensive there. She said she would really like a black car. The site where the auction was held was only able hold 200 cars. On arrival, we noticed the majority of the cars were black. In fact, the auctioneer informed us that 150 of the cars were black and the rest were silver. I said I knew the first car to be shown would be black.

How likely is it that this narrative is true?	0% 1	2	50% 3	4	100% 5
How bizarre do you find this narrative?	Not at all bizarre 1	2	3	4	Extremely bizarre 5
How likely is it that this could happen to you?	Extremely unlikely 1	2	3	4	Extremely likely 5
How likely is it that this could happen to someone you know?	Extremely unlikely 1	2	3	4	Extremely likely 5
How disturbing do you find this narrative?	Not at all disturbing 1	2	3	4	Extremely disturbing 5
How bizarre would the narrative be to most other people?	Not at all bizarre 1	2	3	4	Extremely bizarre 5
How exciting do you find this narrative?	Not at all exciting 1	2	3	4	Extremely exciting 5
How disturbing would the narrative be to most other people?	Not at all disturbing 1	2	3	4	Extremely disturbing 5
How exciting would the narrative be to most other people?	Not at all exciting 1	2	3	4	Extremely exciting 5

8. I signed up to take part in an experiment. When I arrived the experimenter told me he had a jar that was filled with a hundred beads. He informed me that three quarters of the jar was

filled with red beads and the rest of the beads were black. The experimenter showed me the jar of beads. He asked me if I could choose a red bead from the jar without looking. I said I was sure the first bead I would choose from the jar would be red.

How likely is it that this narrative is true?	0% 1	2	50% 3	4	100% 5
How bizarre do you find this narrative?	Not at all bizarre 1	2	3	4	Extremely bizarre 5
How likely is it that this could happen to you?	Extremely unlikely 1	2	3	4	Extremely likely 5
How likely is it that this could happen to someone you know?	Extremely unlikely 1	2	3	4	Extremely likely 5
How disturbing do you find this narrative?	Not at all disturbing 1	2	3	4	Extremely disturbing 5
How bizarre would the narrative be to most other people?	Not at all bizarre 1	2	3	4	Extremely bizarre 5
How exciting do you find this narrative?	Not at all exciting 1	2	3	4	Extremely exciting 5
How disturbing would the narrative be to most other people?	Not at all disturbing 1	2	3	4	Extremely disturbing 5
How exciting would the narrative be to most other people?	Not at all exciting 1	2	3	4	Extremely exciting 5

Appendix 7 – Eysenck Lie Scale (Eysenck & Eysenck, 1976)

Redacted

Appendix 8 – Information Sheet

Personality, creativity, sensation seeking, acquiescence and reasoning as underpinning factors of delusional ideation

Information Sheet

Sub-Clinical Delusional Ideation and Reasoning

You are invited to participate in a study of beliefs and reasoning. The purpose of this study is to investigate if strong beliefs are related to certain thinking styles.

The study is being conducted by Claire Jones (Claire.Jones@wlv.ac.uk) as part of a PhD under the supervision of Dr Niall Galbraith (N.Galbraith@wlv.ac.uk) in the Department of Psychology at the University of Wolverhampton.

If you decide to participate you will be required to complete a number of questionnaires related to beliefs, interests and preferences, personality and creativity. Some questions also relate to experiences of drug use. You are reminded that all responses are anonymous. There are no right or wrong answers and you should answer the questions as honestly as you can. You will also be required to assess a series of narratives. This involves reading nine short narratives and indicating probabilities for each on a five-point scale. This study will take no longer than 1 hour to complete and you will receive 1 credit of participant pool time.

Any information gathered in this study will remain anonymous. No individual will be identified in any publication of results. All data will be locked in a cabinet in the investigator's office for a period of five years upon which it will be destroyed. Only the investigators will have access to this information. You are also reminded that you are free to withdraw at any point during the study without giving a reason and without consequence. However, once responses are submitted to the researcher you will not be able to withdraw your data due to all responses being unidentifiable to the researcher.

If you are interested in receiving a summary of this study, this can be obtained by emailing (Claire.Jones@wlv.ac.uk) in May 2012.

If you consent to participate in this study please sign the Consent Form provided and return to the investigator.

Thank you for your participation.

Claire Jones

Appendix 9 – Consent Form

Consent Form

Study Title: Sub-Clinical Delusional Ideation and Reasoning

Researcher: Claire Jones - PhD Student

In signing this form I agree that I have read and understood the information sheet provided.

I understand that I will be asked to complete a number of questionnaires measuring beliefs, interests and preferences, personality and creativity.

I have had time to ask questions of the researcher and any questions have been answered to my satisfaction.

I understand that my responses are anonymous.

I understand that I am free to withdraw from this study at any time without giving a reason and without consequence up to the submission of my responses when my data will be anonymous to the researcher.

I consent to take part in this study.

Name………………….

Signature………………

Date……………………

Appendix 10 – Sensation Seeking Scale Form V (Zuckerman, 1994)

Redacted

Appendix 11 – Gough's (1979) Creative Personality Scale

Redacted

Appendix 12 – Emotional Creativity Inventory (Averill, 1999)

Redacted

Appendix 13 – Remote Associate Test (Mednick, 1962)

Redacted

Appendix 14 – Response Acquiescence (Winkler, Kanouse & Ware, 1982)

Redacted

Appendix 15 - 20-Item Mini-IPIP (Donnellan, Oswald, Baird, and Lucas, 2006)

Redacted

Appendix 16 – Information Sheet

Delusional thinking and reasoning: The effect of creativity and apophenia

Information Sheet

Beliefs, Creativity and Reasoning

You are invited to participate in a study of beliefs and reasoning. The purpose of this study is to investigate if strong beliefs are related to certain thinking styles.

The study is being conducted by Claire Jones (Claire.Jones@wlv.ac.uk) as part of a PhD under the supervision of Dr Niall Galbraith (N.Galbraith@wlv.ac.uk) in the Department of Psychology at the University of Wolverhampton.

If you decide to participate you will be required to complete a number of questionnaires related to beliefs and creativity and partake in a computerised experimental task. There are no right or wrong answers and you should answer the questions as honestly as you can. You will also be required to assess a series of narratives. This involves reading seven short narratives and assigning ratings for each on a five-point scale. This study will take no longer than 45 minutes to complete and you will receive 0.75 credits of participant pool time.

Any information gathered in this study will remain anonymous. No individual will be identified in any publication of results. All data will be locked in a cabinet in the investigator's office for a period of five years upon which it will be destroyed. Only the investigators will have access to this information. You are also reminded that you are free to withdraw at any point during the study without giving a reason and without consequence. However, once responses are submitted to the researcher you will not be able to withdraw your data due to all responses being unidentifiable to the researcher.

If you are interested in receiving a summary of this study, this can be obtained by emailing (Claire.Jones@wlv.ac.uk) in May 2013.

If you consent to participate in this study please sign the Consent Form provided and return to the investigator.

Thank you for your participation.

Claire Jones

Appendix 17 - Consent form

Consent Form

Study Title: Beliefs, Creativity and Reasoning

Researcher: Claire Jones - PhD Student

In signing this form I agree that I have read and understood the information sheet provided.

I understand that I will be asked to complete a number of questionnaires measuring beliefs, creativity and reasoning and take part in an experimental task.

I have had time to ask questions of the researcher and any questions have been answered to my satisfaction.

I understand that my responses are anonymous.

I understand that I am free to withdraw from this study at any time without giving a reason and without consequence up to the submission of my responses when my data will be anonymous to the researcher.

I consent to take part in this study.

Name………………….

Signature………………

Date……………………

Appendix 18 – Delusional Narratives

Please read the following narratives and circle the appropriate answer accordingly.

1. While working, Reece began to feel that he had such enormous insight into subject areas he hadn't previously studied. He began to think of himself as being somewhat special and having a special mind to be thinking these things. He thought he was ‘chosen’.

How likely is it that this narrative is true?	0% 1	2	50% 3	4	100% 5
How exciting do you find this narrative?	Not at all exciting 1	2	3	4	Extremely exciting 5
How exciting would the narrative be to most other people?	Not at all exciting 1	2	3	4	Extremely exciting 5

3. One of Josh’s duties was to read information intended for military personnel. He became convinced that he was reading top secret information and that someone would try to have him followed so that he couldn't talk. He began to suspect that he was being observed.

How likely is it that this narrative is true?	0% 1	2	50% 3	4	100% 5
How exciting do you find this narrative?	Not at all exciting 1	2	3	4	Extremely exciting 5
How exciting would the narrative be to most other people?	Not at all exciting 1	2	3	4	Extremely exciting 5

5. One day, Jessica saw a movie poster for "The Net," starring Sandra Bullock. Because she had brown eyes and brown hair as she did, she realized that Sandra Bullock was meant to represent her.

How likely is it that this narrative is true?	0% 1	2	50% 3	4	100% 5
How exciting do you find this narrative?	Not at all exciting 1	2	3	4	Extremely exciting 5
How exciting would the narrative be to most other people?	Not at all exciting 1	2	3	4	Extremely exciting 5

7. On the job as a machinist, Natalie began to think that others could somehow know what she was thinking. She couldn't help but suspect that some people in her presence knew her thoughts.

How likely is it that this narrative is true?	0% 1	2	50% 3	4	100% 5
How exciting do you find this narrative?	Not at all exciting 1	2	3	4	Extremely exciting 5
How exciting would the narrative be to most other people?	Not at all exciting 1	2	3	4	Extremely exciting 5

Appendix 19 – Neutral Narratives

2. Someone unfamiliar rang Jodie's doorbell one day. She looked from behind the curtain and thought the man looked like a salesman and that he would probably try to sell her something she didn't really want. She decided that she should answer the door since it would be rude not to.

How likely is it that this narrative is true?	0% 1	2	50% 3	4	100% 5
How exciting do you find this narrative?	Not at all exciting 1	2	3	4	Extremely exciting 5
How exciting would the narrative be to most other people?	Not at all exciting 1	2	3	4	Extremely exciting 5

4. Brad's colleague Nick had been looking for a used car. Brad suggested that he should go to have a look at a car auction. Nick said he would really like a black car. When they arrived at the auction they noticed the majority of the cars were black.

How likely is it that this narrative is true?	0% 1	2	50% 3	4	100% 5
How exciting do you find this narrative?	Not at all exciting 1	2	3	4	Extremely exciting 5
How exciting would the narrative be to most other people?	Not at all exciting 1	2	3	4	Extremely exciting 5

6. Karen owned a lot of modern art. Since moving to a smaller house she had found it hard to find a place for everything and considered whether she should sell or use a storage facility for some of her art to make more space.

How likely is it that this narrative is true?	0% 1	2	50% 3	4	100% 5
How exciting do you find this narrative?	Not at all exciting 1	2	3	4	Extremely exciting 5
How exciting would the narrative be to most other people?	Not at all exciting 1	2	3	4	Extremely exciting 5

Appendix 20 - Snowy Pictures Task (Ekstrom, French, Harman, & Dermen, 1976)

Redacted

Appendix 21 – Information Sheet

Creativity and non-perceptual apophenia as factors in delusional thinking and reasoning

Information Sheet

Beliefs, Reasoning and Creativity

You are invited to participate in a study of beliefs and reasoning. The purpose of this study is to investigate if strong beliefs are related to certain thinking styles.

The study is being conducted by Claire Jones (Claire.Jones@wlv.ac.uk) as part of a PhD under the supervision of Dr Niall Galbraith (N.Galbraith@wlv.ac.uk) in the Department of Psychology at the University of Wolverhampton.

If you decide to participate you will be required to complete questionnaires related to your beliefs and reasoning and take part in an experimental task. There are no right or wrong answers and you should answer the questions as honestly as you can. You will also be required to assess a series of narratives. This involves reading seven short narratives and assigning ratings for each on a five-point scale. This study will take no longer than 45 minutes to complete and you will receive 0.75 credits of participant pool time.

Any information gathered in this study will remain anonymous. No individual will be identified in any publication of results. All data will be locked in a cabinet in the investigator's office for a period of five years upon which it will be destroyed. Only the investigators will have access to this information. You are also reminded that you are free to withdraw at any point during the study without giving a reason and without consequence. However, once responses are submitted to the researcher you will not be able to withdraw your data due to all responses being unidentifiable to the researcher.

If you are interested in receiving a summary of this study, this can be obtained by emailing (Claire.Jones@wlv.ac.uk) in August 2013.

If you consent to participate in this study please sign the Consent Form provided and return to the investigator.

Thank you for your participation.

Claire Jones

Appendix 22 – Consent form

Consent Form

Study Title: Beliefs, Reasoning and Creativity

Researcher: Claire Jones - PhD Student

In signing this form I agree that I have read and understood the information sheet provided.

I understand that I will be asked to complete questionnaires measuring belief and reasoning and take part in an experimental task.

I have had time to ask questions of the researcher and any questions have been answered to my satisfaction.

I understand that my responses are anonymous.

I understand that I am free to withdraw from this study at any time without giving a reason and without consequence up to the submission of my responses when my data will be anonymous to the researcher.

I consent to take part in this study.

Name………………….

Signature………………

Date……………………

Appendix 23 - Bridge-the-Associate-Gap Task (Gianotti et al., 2001)

Redacted

Appendix 24 – Coincidences Questionnaire (Bressan 2002)

Redacted

Appendix 25 – Information sheet

Delusional ideation and decision thresholds: Testing the liberal acceptance account

Beliefs and Reasoning

You are invited to participate in a study of beliefs and reasoning. The purpose of this study is to investigate if strong beliefs are related to certain thinking styles.

The study is being conducted by Claire Jones (Claire.Jones@wlv.ac.uk) under the supervision of Dr Niall Galbraith (N.Galbraith@wlv.ac.uk) in the Department of Psychology at the University of Wolverhampton.

If you decide to participate you will be asked to answer a number of questions related to your beliefs and your experience of coincidences. You will also be asked to assess a series of pictures by assigning plausibility ratings to various interpretations. There are no right or wrong answers and you should answer the questions as honestly as you can. Participation will take no longer than 45 minutes.

This survey is completely anonymous and you will not be asked to provide your name at any point. Your responses will be kept confidential and only the researcher and research supervisors will have access to these. The answers you give will never be traced back to you.

Participation is voluntary and you can always withdraw from the study at any point during the survey if you want to, up to the point that you submit your responses. If, however, you are happy to take part, then please try to answer all of the questions.

Claire Jones
Department of Psychology
Faculty of Health, Education and Wellbeing
University of Wolverhampton
Wolverhampton
WV1 1LY

Email: Claire.Jones@wlv.ac.uk
Tel: 01902 321374

Appendix 26 – Consent

Consent

BEFORE beginning the survey, please make sure that you understand the statements below:

- ☐ I understand that it is up to me if I take part in this survey.
- ☐ If I decide to do this survey, I understand that I am allowed to change my mind after I have started it.
- ☐ I know that my answers are anonymous and that they cannot be traced back to me.
- ☐ I understand that once I have finished the survey, I cannot withdraw my answers.

If you agree with all of the above statements, please click the button below to begin the survey.

Appendix 27 – Thematic Apperception Test (Murray, 1943)

Redacted

Appendix 28 – Debrief

Thank you for your participation. It is hoped that this study will tell us more about the way people reason about stimuli with interpretations of differing plausibility and how this relates to strong beliefs.

If you would like to receive a summary of this study, this can be obtained by emailing the researcher at Claire.Jones@wlv.ac.uk in August 2014.

If you have any further questions, please do not hesitate to contact me.

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Tel: 01902 321374

Appendix 29 – Information sheet

Delusional Ideation and Decision Thresholds: Who wants to be a Millionaire?

Beliefs and Decision Making

You are invited to participate in a study of beliefs and decision making. The purpose of this study is to investigate if strong beliefs are related to the way we make decisions.

The study is being conducted by Claire Jones (Claire.Jones@wlv.ac.uk) under the supervision of Dr Niall Galbraith (N.Galbraith@wlv.ac.uk) in the Institute of Psychology at the University of Wolverhampton.

If you decide to participate you will be asked to consider 20 general knowledge questions and provide an estimate for four alternative answers. You will then be asked whether you would accept or reject the answer based on your estimates. You will also be asked a number of questions related to your beliefs. There are no right or wrong answers and you should answer the questions as honestly as you can. Participation will take no longer than 45 minutes.

This survey is completely anonymous and you will not be asked to provide your name at any point. Your responses will be kept confidential and only the researcher and research supervisors will have access to these. The answers you give will never be traced back to you.

Participation is voluntary and you can always withdraw from the study at any point during the survey if you want to, up to the point that you submit your responses. If, however, you are happy to take part, then please try to answer all of the questions.

Claire Jones
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Email: Claire.Jones@wlv.ac.uk
Tel: 01902 321374

Appendix 30 – Consent

Consent

BEFORE beginning the survey, please make sure that you understand the statements below:

- ☐ I understand that it is up to me if I take part in this survey.
- ☐ If I decide to do this survey, I understand that I am allowed to change my mind after I have started it.
- ☐ I know that my answers are anonymous and that they cannot be traced back to me.
- ☐ I understand that once I have finished the survey, I cannot withdraw my answers.

If you agree with all of the above statements, please click the button below to begin the survey.

Appendix 31 – General Knowledge Questions for the 'Who Wants to be a Millionaire' task

Below are 20 general knowledge questions. For each of the four answers, we would like you to give a probability estimate between 0% and 100%. There are no right or wrong probably estimates and you should give an estimate that you think is about right. Even if you are entirely certain that an answer is correct, please still give a probability estimate for each answer.

We would also like you to decide which answer you think is right or wrong. Sometimes you absolutely know that something is right or wrong, at other times you can't be sure. When you feel that you really can't make a decision, there is an additional option of 'can't be absolutely sure' for this. You can decide which answer is right or wrong (or if you 'can't be absolutely sure') after each estimate you provide or after you have given estimates to all four answers. You can also go back to previous questions if you change your mind.

Please see the example scenarios below for guidance on completing this part of the survey:

Example 1

You are asked the question: How many fingers does Mickey Mouse have?

The four alternative answers are 10, 12, 8 and 6. You think that the answer could be that Mickey Mouse has either 10 or 8 fingers. So you give 50% for the answer 10 fingers and 50% for the answer 8 fingers. You think the chance of Mickey Mouse having 12 fingers is small, so you give this 20% and the chance of Mickey Mouse having 6 fingers is even smaller, so you give this 10%. You decide to go for the answer of Mickey Mouse having 10 fingers and indicate this by choosing 'I would say this is right'. You may still be unsure about whether Mickey Mouse has 8 fingers so for this you might choose 'can't be absolutely sure'. For the other alternative answers (12 and 6 fingers) you choose 'I would say this is wrong'.

Example 2

You are asked the question: Which one of the following is not a character from the standard edition of the board game Cluedo?

The four alternative answers are Captain Scarlett, Professor Plum, Reverend Green and Mrs White. You are pretty sure that the answer is not Mrs White or Reverend Green and you give these both 20% and choose 'I would say this is wrong'. You are less certain about Professor Plum so you give this 30% and choose 'can't be absolutely sure'. You give the remaining answer (Captain Scarlett) 40% and choose 'I would say this is right'.

Below are 2 trial questions for you to practice this task. You will then begin the 20 general knowledge questions.

Redacted

Appendix 32 – Information sheet

Liberal acceptance and underpinning factors of subclinical delusional ideation

Beliefs and Reasoning

You are invited to participate in a study of beliefs and reasoning. The purpose of this study is to investigate if strong beliefs are related to certain thinking styles.

The study is being conducted by Claire Jones (Claire.Jones@wlv.ac.uk) under the supervision of Dr Niall Galbraith (N.Galbraith@wlv.ac.uk) in the Institute of Psychology at the University of Wolverhampton.

If you decide to participate you will be asked to assess a series of narratives and answer a number of questions related to your beliefs and your experience of coincidences. You will also be asked to assess a series of pictures by assigning plausibility ratings to various interpretations and completing an experimental picture task. There are no right or wrong answers and you should answer the questions as honestly as you can. Participation will take no longer than 1 hour.

This survey is completely anonymous and you will not be asked to provide your name at any point. Your responses will be kept confidential and only the researcher and research supervisors will have access to these. The answers you give will never be traced back to you.

Participation is voluntary and you can always withdraw from the study at any point during the survey if you want to, up to the point that you submit your responses. If, however, you are happy to take part, then please try to answer all of the questions.

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Appendix 33 – Consent

Consent

BEFORE beginning the survey, please make sure that you understand the statements below:

- I understand that it is up to me if I take part in this survey.
- If I decide to do this survey, I understand that I am allowed to change my mind after I have started it.
- I know that my answers are anonymous and that they cannot be traced back to me.
- I understand that once I have finished the survey, I cannot withdraw my answers.

If you agree with all of the above statements, please click the button below to begin the survey.

Appendix 34 – Debrief

Thank you for your participation. It is hoped that this study will tell us more about the way people reason and how this relates to strong beliefs.

If you would like to receive a summary of this study, this can be obtained by emailing the researcher at Claire.Jones@wlv.ac.uk in October 2016.

If you have any further questions, please do not hesitate to contact me.

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Appendix 35 – SPSS outputs for regression analyses showing PDI score as a continuous IV

Chapter 2

Regression

Descriptive Statistics

	Mean	Std. Deviation	N
Exciting_overall	5.3714	1.28809	101
Total_PDI_score	59.8020	34.73903	101

Correlations

		Exciting_overall	Total_PDI_score
Pearson Correlation	Exciting_overall	1.000	.211
	Total_PDI_score	.211	1.000
Sig. (1-tailed)	Exciting_overall	.	.017
	Total_PDI_score	.017	.
N	Exciting_overall	101	101
	Total_PDI_score	101	101

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Total_PDI_score[b]	.	Enter

a. Dependent Variable: Exciting_overall

b. All requested variables entered.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.211[a]	.045	.035	1.26543	1.907

a. Predictors: (Constant), Total_PDI_score

b. Dependent Variable: Exciting_overall

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.390	1	7.390	4.615	.034[b]
	Residual	158.529	99	1.601		
	Total	165.919	100			

a. Dependent Variable: Exciting_overall

b. Predictors: (Constant), Total_PDI_score

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Correlations Zero-order	Correlations Partial	Correlations Part
1	(Constant)	4.903	.252		19.488	.000			
	Total_PDI_score	.008	.004	.211	2.148	.034	.211	.211	.211

a. Dependent Variable: Exciting_overall

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	4.9035	6.3433	5.3714	.27184	101
Residual	-2.98211	2.39523	.00000	1.25908	101
Std. Predicted Value	-1.721	3.575	.000	1.000	101
Std. Residual	-2.357	1.893	.000	.995	101

a. Dependent Variable: Exciting_overall

Chapter 3

Regression

Descriptive Statistics

	Mean	Std. Deviation	N
True_overall_2	3.1879	.60650	65
Total_PDI_Score	55.9692	41.17758	65

Correlations

		True_overall_2	Total_PDI_Score
Pearson Correlation	True_overall_2	1.000	.232
	Total_PDI_Score	.232	1.000
Sig. (1-tailed)	True_overall_2	.	.032
	Total_PDI_Score	.032	.
N	True_overall_2	65	65
	Total_PDI_Score	65	65

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Total_PDI_Score[b]	.	Enter

a. Dependent Variable: True_overall_2

b. All requested variables entered.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.232[a]	.054	.039	.59464	2.295

a. Predictors: (Constant), Total_PDI_Score

b. Dependent Variable: True_overall_2

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.265	1	1.265	3.579	.063[b]
	Residual	22.277	63	.354		
	Total	23.542	64			

a. Dependent Variable: True_overall_2

b. Predictors: (Constant), Total_PDI_Score

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	2.997	.125		23.958	.000			
	Total_PDI_Score	.003	.002	.232	1.892	.063	.232	.232	.232

a. Dependent Variable: True_overall_2

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	2.9968	3.6627	3.1879	.14061	65
Residual	-1.43327	1.44966	.00000	.58997	65
Std. Predicted Value	-1.359	3.376	.000	1.000	65
Std. Residual	-2.410	2.438	.000	.992	65

a. Dependent Variable: True_overall_2

****

Regression

Descriptive Statistics

	Mean	Std. Deviation	N
Exciting_overall	4.8698	1.30958	65
Total_PDI_Score	55.9692	41.17758	65

Correlations

		Exciting_overall	Total_PDI_Score
Pearson Correlation	Exciting_overall	1.000	.316
	Total_PDI_Score	.316	1.000
Sig. (1-tailed)	Exciting_overall	.	.005
	Total_PDI_Score	.005	.
N	Exciting_overall	65	65
	Total_PDI_Score	65	65

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Total_PDI_Score[b]	.	Enter

a. Dependent Variable: Exciting_overall

b. All requested variables entered.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.316[a]	.100	.086	1.25222	1.982

a. Predictors: (Constant), Total_PDI_Score

b. Dependent Variable: Exciting_overall

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10.971	1	10.971	6.997	.010[b]
	Residual	98.788	63	1.568		
	Total	109.759	64			

a. Dependent Variable: Exciting_overall

b. Predictors: (Constant), Total_PDI_Score

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Correlations Zero-order	Correlations Partial	Correlations Part
1	(Constant)	4.307	.263		16.351	.000			
	Total_PDI_Score	.010	.004	.316	2.645	.010	.316	.316	.316

a. Dependent Variable: Exciting_overall

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	4.3070	6.2678	4.8698	.41404	65
Residual	-2.29350	3.89104	.00000	1.24240	65
Std. Predicted Value	-1.359	3.376	.000	1.000	65
Std. Residual	-1.832	3.107	.000	.992	65

a. Dependent Variable: Exciting_overall

****

Chapter 4

Regression

Descriptive Statistics

	Mean	Std. Deviation	N
Snowy Pictures False Positives	3.1935	2.45063	93
Total_PDI_Score	55.4086	39.21713	93

Correlations

		Snowy Pictures False Positives	Total_PDI_Score
Pearson Correlation	Snowy Pictures False Positives	1.000	.206
	Total_PDI_Score	.206	1.000
Sig. (1-tailed)	Snowy Pictures False Positives	.	.024
	Total_PDI_Score	.024	.
N	Snowy Pictures False Positives	93	93
	Total_PDI_Score	93	93

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Total_PDI_Score[b]	.	Enter

a. Dependent Variable: Snowy Pictures False Positives

b. All requested variables entered.

Model Summary[b]

					Change Statistics					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
1	.206[a]	.042	.032	2.41143	.042	4.015	1	91	.048	2.340

a. Predictors: (Constant), Total_PDI_Score

b. Dependent Variable: Snowy Pictures False Positives

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	23.350	1	23.350	4.015	.048[b]
	Residual	529.167	91	5.815		
	Total	552.516	92			

a. Dependent Variable: Snowy Pictures False Positives

b. Predictors: (Constant), Total_PDI_Score

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Correlations		
		B	Std. Error	Beta	t	Sig.	Zero-order	Partial	Part
1	(Constant)	2.482	.434		5.713	.000			
	Total_PDI_Score	.013	.006	.206	2.004	.048	.206	.206	.206

a. Dependent Variable: Snowy Pictures False Positives

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	2.4818	4.5628	3.1935	.50379	93
Residual	-3.68930	6.77316	.00000	2.39829	93
Std. Predicted Value	-1.413	2.718	.000	1.000	93
Std. Residual	-1.530	2.809	.000	.995	93

a. Dependent Variable: Snowy Pictures False Positives

****

Regression

Descriptive Statistics

	Mean	Std. Deviation	N
Snowy Pictures Attempt Made but Incorrect	4.3548	2.38494	93
Total_PDI_Score	55.4086	39.21713	93

Correlations

		Snowy Pictures Attempt Made but Incorrect	Total_PDI_Score
Pearson Correlation	Snowy Pictures Attempt Made but Incorrect	1.000	.227
	Total_PDI_Score	.227	1.000
Sig. (1-tailed)	Snowy Pictures Attempt Made but Incorrect	.	.014
	Total_PDI_Score	.014	.
N	Snowy Pictures Attempt Made but Incorrect	93	93
	Total_PDI_Score	93	93

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Total_PDI_Score[b]	.	Enter

a. Dependent Variable: Snowy Pictures Attempt Made but Incorrect

b. All requested variables entered.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.227[a]	.052	.041	2.33533	.052	4.950	1	91	.029	1.646

a. Predictors: (Constant), Total_PDI_Score

b. Dependent Variable: Snowy Pictures Attempt Made but Incorrect

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	26.998	1	26.998	4.950	.029[b]
	Residual	496.292	91	5.454		
	Total	523.290	92			

a. Dependent Variable: Snowy Pictures Attempt Made but Incorrect

b. Predictors: (Constant), Total_PDI_Score

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Correlations Zero-order	Correlations Partial	Correlations Part
1	(Constant)	3.589	.421		8.532	.000			
	Total_PDI_Score	.014	.006	.227	2.225	.029	.227	.227	.227

a. Dependent Variable: Snowy Pictures Attempt Made but Incorrect

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	3.5895	5.8272	4.3548	.54172	93
Residual	-3.89335	8.83038	.00000	2.32260	93
Std. Predicted Value	-1.413	2.718	.000	1.000	93
Std. Residual	-1.667	3.781	.000	.995	93

a. Dependent Variable: Snowy Pictures Attempt Made but Incorrect

Chapter 5

Regression

Descriptive Statistics

	Mean	Std. Deviation	N
True_overall	3.8813	.93641	83
Total_PDI_Score	48.0241	35.28489	83

Correlations

		True_overall	Total_PDI_Score
Pearson Correlation	True_overall	1.000	.310
	Total_PDI_Score	.310	1.000
Sig. (1-tailed)	True_overall	.	.002
	Total_PDI_Score	.002	.
N	True_overall	83	83
	Total_PDI_Score	83	83

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Total_PDI_Score[b]	.	Enter

a. Dependent Variable: True_overall

b. All requested variables entered.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.310[a]	.096	.085	.89582	2.013

a. Predictors: (Constant), Total_PDI_Score

b. Dependent Variable: True_overall

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.901	1	6.901	8.600	.004[b]
	Residual	65.002	81	.802		
	Total	71.904	82			

a. Dependent Variable: True_overall

b. Predictors: (Constant), Total_PDI_Score

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Correlations Zero-order	Correlations Partial	Correlations Part
1	(Constant)	3.486	.167		20.911	.000			
	Total_PDI_Score	.008	.003	.310	2.933	.004	.310	.310	.310

a. Dependent Variable: True_overall

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	3.4865	4.8266	3.8813	.29011	83
Residual	-2.14710	2.20109	.00000	.89034	83
Std. Predicted Value	-1.361	3.259	.000	1.000	83
Std. Residual	-2.397	2.457	.000	.994	83

a. Dependent Variable: True_overall

****

Regression

Descriptive Statistics

	Mean	Std. Deviation	N
Exciting_overall	4.3781	1.15699	80
Total_PDI_Score	48.0750	35.10591	80

Correlations

		Exciting_overall	Total_PDI_Score
Pearson Correlation	Exciting_overall	1.000	.329
	Total_PDI_Score	.329	1.000
Sig. (1-tailed)	Exciting_overall	.	.001
	Total_PDI_Score	.001	.
N	Exciting_overall	80	80
	Total_PDI_Score	80	80

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Total_PDI_Score[b]	.	Enter

a. Dependent Variable: Exciting_overall

b. All requested variables entered.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.329[a]	.108	.097	1.09953	1.786

a. Predictors: (Constant), Total_PDI_Score

b. Dependent Variable: Exciting_overall

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.453	1	11.453	9.474	.003[b]
	Residual	94.299	78	1.209		
	Total	105.752	79			

a. Dependent Variable: Exciting_overall

b. Predictors: (Constant), Total_PDI_Score

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Correlations Zero-order	Correlations Partial	Correlations Part
1	(Constant)	3.857	.209		18.426	.000			
	Total_PDI_Score	.011	.004	.329	3.078	.003	.329	.329	.329

a. Dependent Variable: Exciting_overall

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	3.8567	5.6246	4.3781	.38076	80
Residual	-1.82254	3.01038	.00000	1.09254	80
Std. Predicted Value	-1.369	3.274	.000	1.000	80
Std. Residual	-1.658	2.738	.000	.994	80

a. Dependent Variable: Exciting_overall

Chapter 6

Regression

Descriptive Statistics

	Mean	Std. Deviation	N
Total_coincidences	20.2212	5.31966	113
Total_PDI_Score	55.1416	42.40196	113

Correlations

		Total_coincidences	Total_PDI_Score
Pearson Correlation	Total_coincidences	1.000	.373
	Total_PDI_Score	.373	1.000
Sig. (1-tailed)	Total_coincidences	.	.000
	Total_PDI_Score	.000	.
N	Total_coincidences	113	113
	Total_PDI_Score	113	113

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Total_PDI_Score[b]	.	Enter

a. Dependent Variable: Total_coincidences

b. All requested variables entered.

Model Summary[b]

					Change Statistics					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
1	.373[a]	.139	.132	4.95697	.139	17.989	1	111	.000	2.063

a. Predictors: (Constant), Total_PDI_Score

b. Dependent Variable: Total_coincidences

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	442.022	1	442.022	17.989	.000[b]
	Residual	2727.447	111	24.572		
	Total	3169.469	112			

a. Dependent Variable: Total_coincidences

b. Predictors: (Constant), Total_PDI_Score

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Correlations		
		B	Std. Error	Beta	t	Sig.	Zero-order	Partial	Part
1	(Constant)	17.638	.767		22.992	.000			
	Total_PDI_Score	.047	.011	.373	4.241	.000	.373	.373	.373

a. Dependent Variable: Total_coincidences

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	17.6378	29.3976	20.2212	1.98661	113
Residual	-10.00961	12.36373	.00000	4.93480	113
Std. Predicted Value	-1.300	4.619	.000	1.000	113
Std. Residual	-2.019	2.494	.000	.996	113

a. Dependent Variable: Total_coincidences

Chapter 7

No significant group differences were found in Chapter 7.

Chapter 8

Regression

Descriptive Statistics

	Mean	Std. Deviation	N
True_overall	3.7058	.81175	83
Total_PDI	57.2892	43.22841	83

Correlations

		True_overall	Total_PDI
Pearson Correlation	True_overall	1.000	.140
	Total_PDI	.140	1.000
Sig. (1-tailed)	True_overall	.	.104
	Total_PDI	.104	.
N	True_overall	83	83
	Total_PDI	83	83

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Total_PDI[b]	.	Enter

a. Dependent Variable: True_overall

b. All requested variables entered.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.140[a]	.020	.007	.80873	1.848

a. Predictors: (Constant), Total_PDI

b. Dependent Variable: True_overall

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.055	1	1.055	1.614	.208[b]
	Residual	52.977	81	.654		
	Total	54.032	82			

a. Dependent Variable: True_overall

b. Predictors: (Constant), Total_PDI

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Correlations		
		B	Std. Error	Beta	t	Sig.	Zero-order	Partial	Part
1	(Constant)	3.555	.148		24.032	.000			
	Total_PDI	.003	.002	.140	1.270	.208	.140	.140	.140

a. Dependent Variable: True_overall

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	3.5555	4.2536	3.7058	.11345	83
Residual	-1.42947	2.29494	.00000	.80378	83
Std. Predicted Value	-1.325	4.828	.000	1.000	83
Std. Residual	-1.768	2.838	.000	.994	83

a. Dependent Variable: True_overall

****

Regression

Descriptive Statistics

	Mean	Std. Deviation	N
Total_coincidences	20.0723	5.49009	83
Total_PDI	57.2892	43.22841	83

Correlations

		Total_coincidences	Total_PDI
Pearson Correlation	Total_coincidences	1.000	.221
	Total_PDI	.221	1.000
Sig. (1-tailed)	Total_coincidences	.	.023
	Total_PDI	.023	.
N	Total_coincidences	83	83
	Total_PDI	83	83

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Total_PDI[b]	.	Enter

a. Dependent Variable: Total_coincidences

b. All requested variables entered.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.221[a]	.049	.037	5.38790	.049	4.140	1	81	.045	1.594

a. Predictors: (Constant), Total_PDI

b. Dependent Variable: Total_coincidences

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	120.176	1	120.176	4.140	.045[b]
	Residual	2351.390	81	29.030		
	Total	2471.566	82			

a. Dependent Variable: Total_coincidences

b. Predictors: (Constant), Total_PDI

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	18.468	.986		18.737	.000			
	Total_PDI	.028	.014	.221	2.035	.045	.221	.221	.221

a. Dependent Variable: Total_coincidences

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	18.4679	25.9172	20.0723	1.21060	83
Residual	-10.46792	18.18785	.00000	5.35495	83
Std. Predicted Value	-1.325	4.828	.000	1.000	83
Std. Residual	-1.943	3.376	.000	.994	83

a. Dependent Variable: Total_coincidences

Appendix 36 – SPSS outputs screening for normality

Chapter 2

Explore

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Narratives_overall	101	100.0%	0	0.0%	101	100.0%

Descriptives

			Statistic	Std. Error
Narratives_overall	Mean		4.8903	.05128
	95% Confidence Interval for Mean	Lower Bound	4.7885	
		Upper Bound	4.9920	
	5% Trimmed Mean		4.8907	
	Median		4.8667	
	Variance		.266	
	Std. Deviation		.51539	
	Minimum		3.61	
	Maximum		6.38	
	Range		2.77	
	Interquartile Range		.68	
	Skewness		.065	.240
	Kurtosis		.332	.476

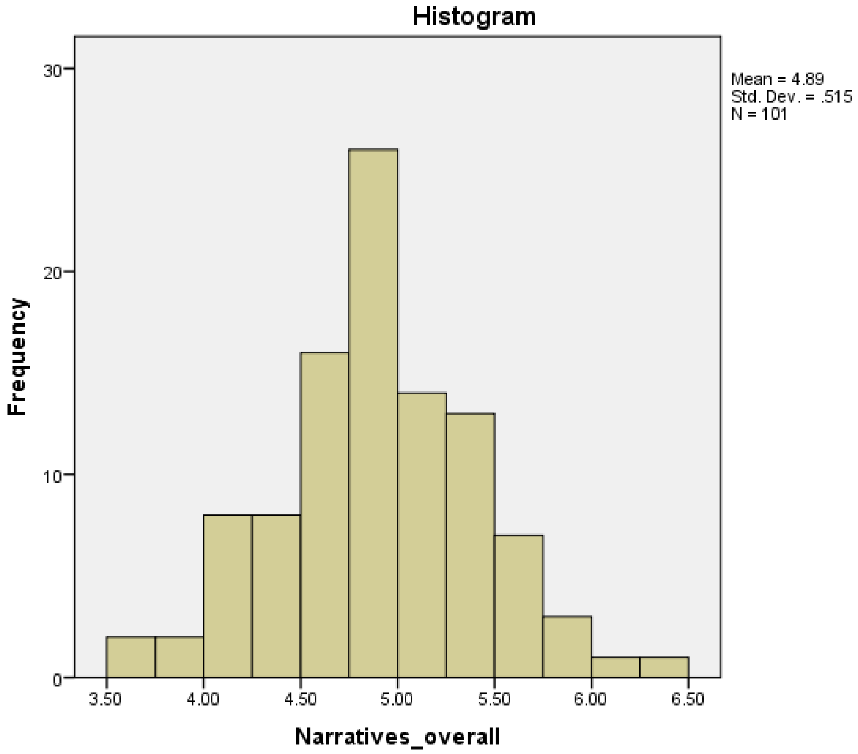
Tests of Normality

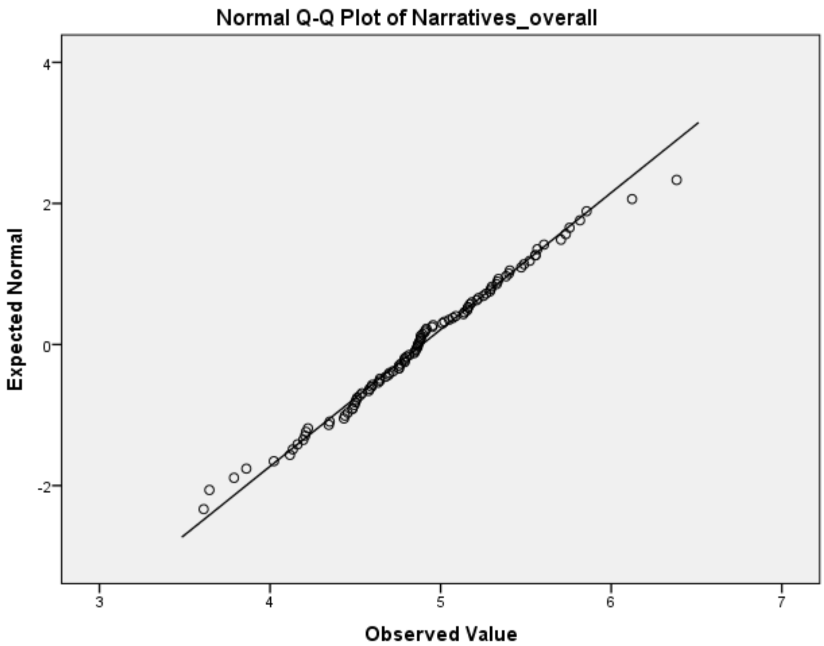
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Narratives_overall	.074	101	.200*	.993	101	.881

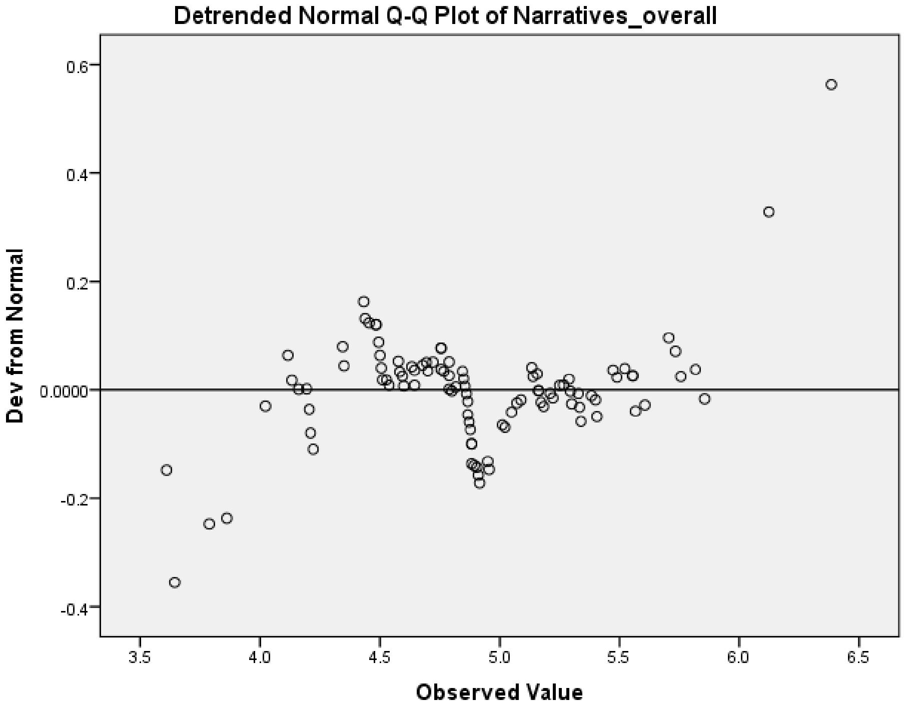
*. This is a lower bound of the true significance.

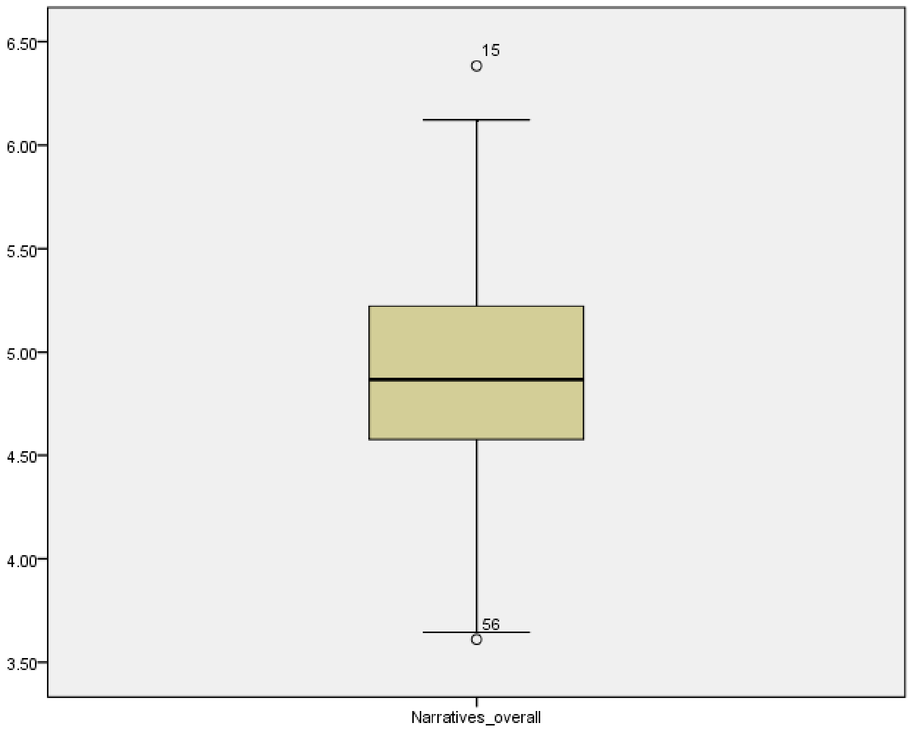
a. Lilliefors Significance Correction

Narratives_overall






Detrended Normal Q-Q Plot of Narratives_overall
Dev from Normal
0.6
0.4
0.2
0.0000
-0.2
-0.4
3.5
4.0
4.5
5.0
5.5
6.0
6.5
Observed Value


6.50
6.00
5.50
5.00
4.50
4.00
3.50
15
56
Narratives_overall

Chapter 3

Explore

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Narratives_overall	65	100.0%	0	0.0%	65	100.0%

Descriptives

			Statistic	Std. Error
Narratives_overall	Mean		4.8215	.09577
	95% Confidence Interval for Mean	Lower Bound	4.6302	
		Upper Bound	5.0128	
	5% Trimmed Mean		4.8297	
	Median		4.8000	
	Variance		.596	
	Std. Deviation		.77214	
	Minimum		2.18	
	Maximum		6.77	
	Range		4.59	
	Interquartile Range		.81	
	Skewness		-.444	.297
	Kurtosis		1.780	.586

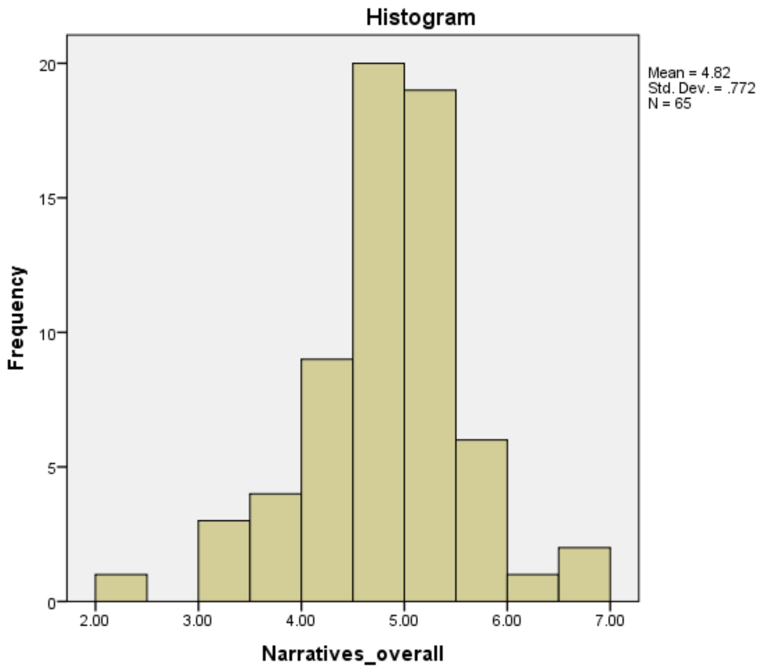
Tests of Normality

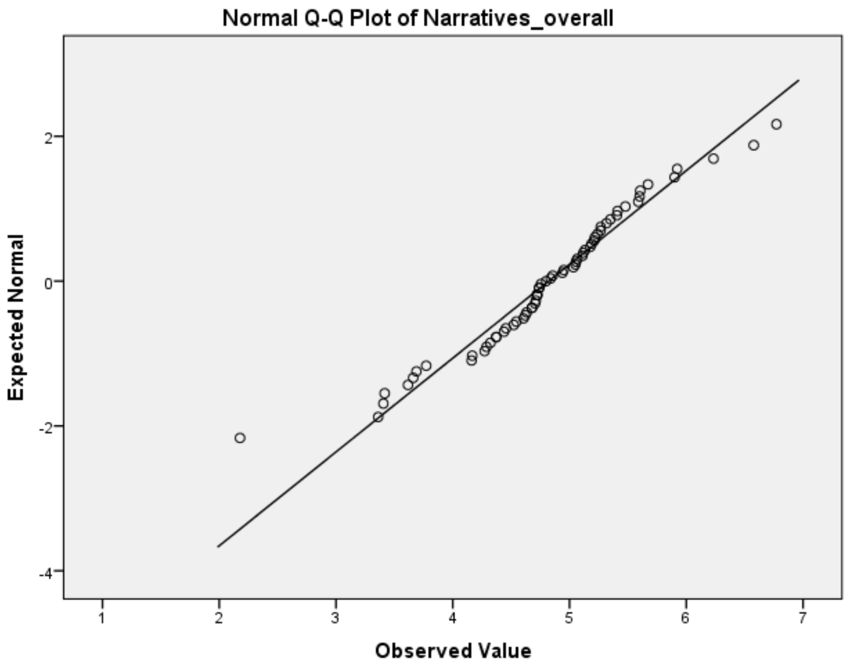
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Narratives_overall	.098	65	.200*	.965	65	.060

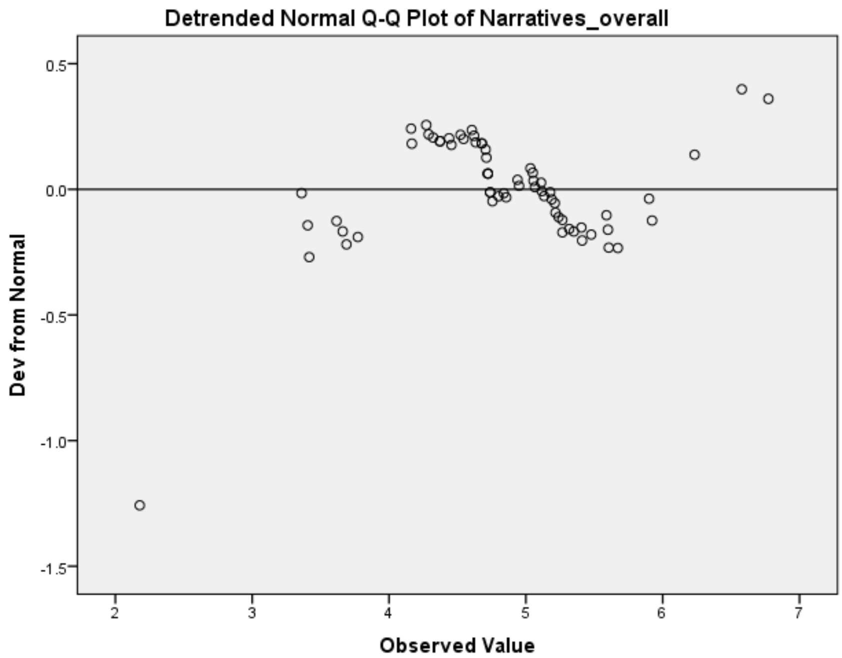
*. This is a lower bound of the true significance.

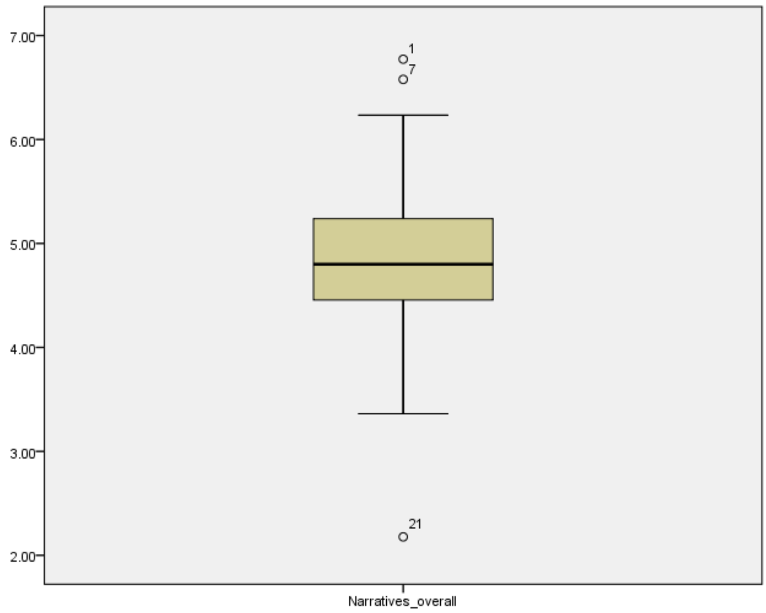
a. Lilliefors Significance Correction

Narratives_overall






Detrended Normal Q-Q Plot of Narratives_overall
Dev from Normal
Observed Value
0.5
0.0
-0.5
-1.0
-1.5
2
3
4
5
6
7


7.00
6.00
5.00
4.00
3.00
2.00
1
7
21
Narratives_overall

<u>**Chapter 4**</u>

Explore

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Narratives_overall	93	100.0%	0	0.0%	93	100.0%

Descriptives

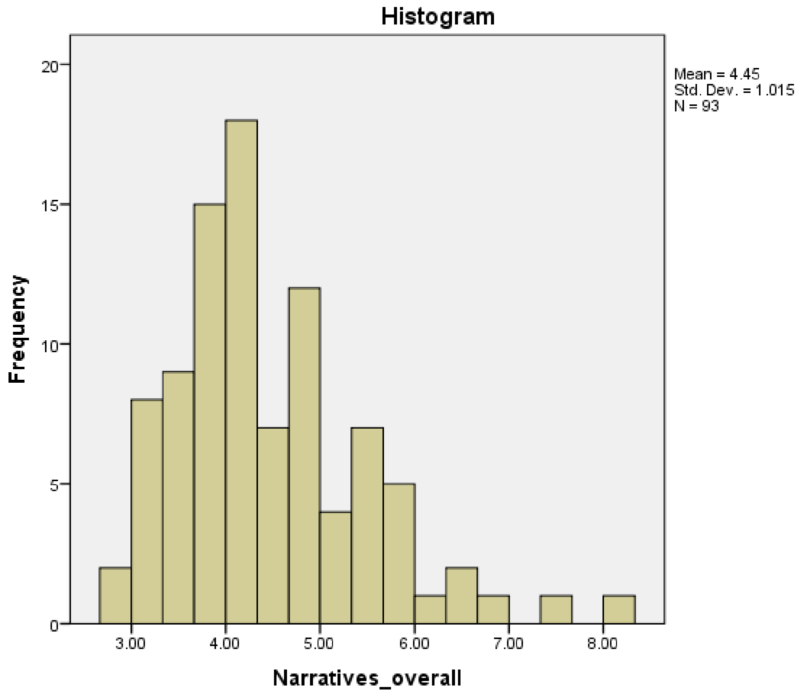
			Statistic	Std. Error
Narratives_overall	Mean		4.4520	.10524
	95% Confidence Interval for Mean	Lower Bound	4.2429	
		Upper Bound	4.6610	
	5% Trimmed Mean		4.3873	
	Median		4.2167	
	Variance		1.030	
	Std. Deviation		1.01493	
	Minimum		2.85	
	Maximum		8.23	
	Range		5.38	
	Interquartile Range		1.22	
	Skewness		1.027	.250
	Kurtosis		1.518	.495

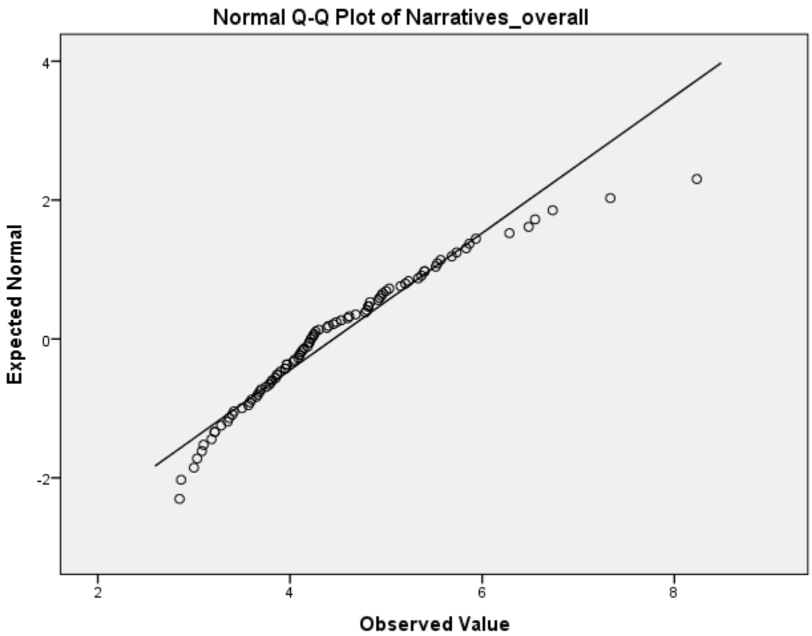
Tests of Normality

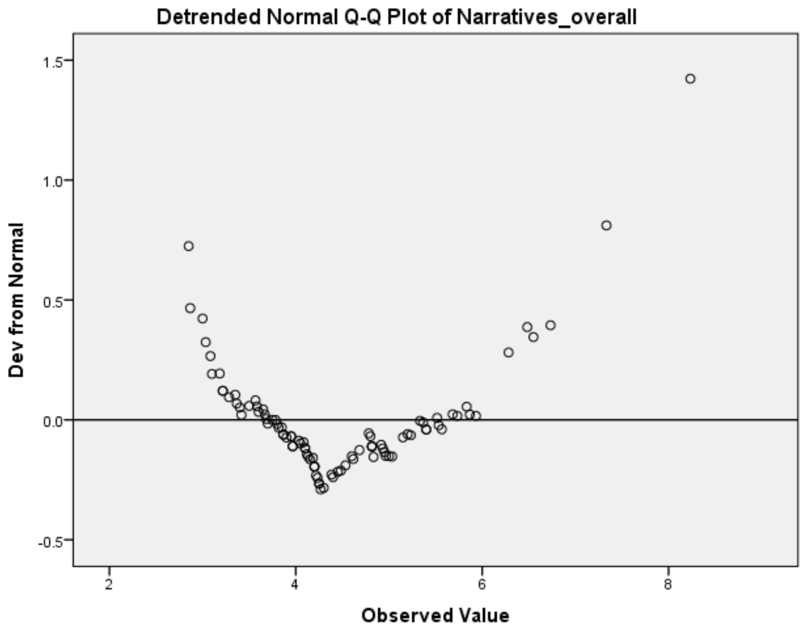
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Narratives_overall	.121	93	.002	.942	93	.000

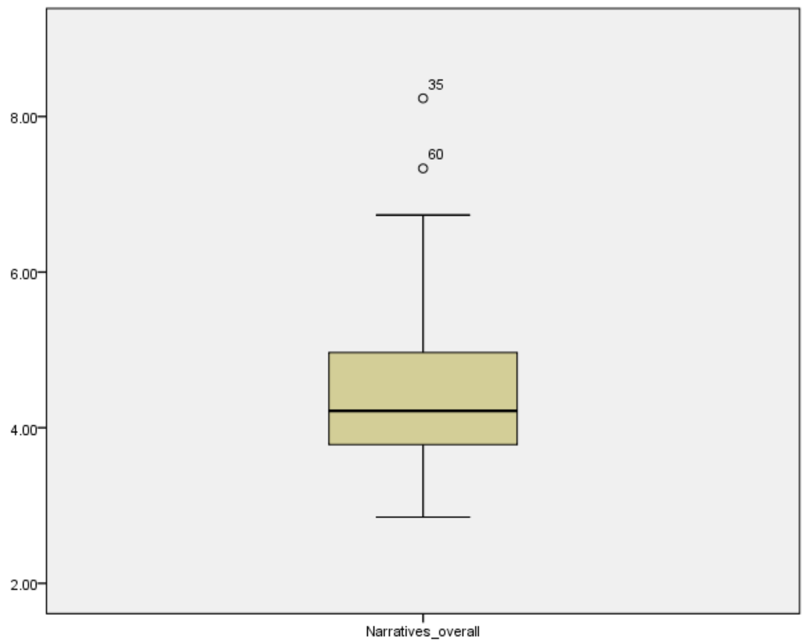
a. Lilliefors Significance Correction

Narratives_overall






Detrended Normal Q-Q Plot of Narratives_overall
Dev from Normal
Observed Value
1.5
1.0
0.5
0.0
-0.5
2
4
6
8


35
60
8.00
6.00
4.00
2.00
Narratives_overall

Snowy Pictures

Explore

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Snowy Pictures correct answers	93	100.0%	0	0.0%	93	100.0%
Snowy Pictures False Positives	93	100.0%	0	0.0%	93	100.0%
Snowy Pictures Attempt Made but Incorrect	93	100.0%	0	0.0%	93	100.0%
Snowy Pictures None Correct	93	100.0%	0	0.0%	93	100.0%

Descriptives

			Statistic	Std. Error
Snowy Pictures correct answers	Mean		7.1075	.27069
	95% Confidence Interval for Mean	Lower Bound	6.5699	
		Upper Bound	7.6451	
	5% Trimmed Mean		7.2939	
	Median		7.0000	
	Variance		6.814	
	Std. Deviation		2.61044	
	Minimum		.00	
	Maximum		11.00	
	Range		11.00	
	Interquartile Range		3.00	
	Skewness		-1.162	.250
	Kurtosis		1.359	.495
Snowy Pictures False Positives	Mean		3.1935	.25412
	95% Confidence Interval for Mean	Lower Bound	2.6888	
		Upper Bound	3.6983	
	5% Trimmed Mean		3.0681	
	Median		3.0000	
	Variance		6.006	
	Std. Deviation		2.45063	
	Minimum		.00	
	Maximum		10.00	
	Range		10.00	

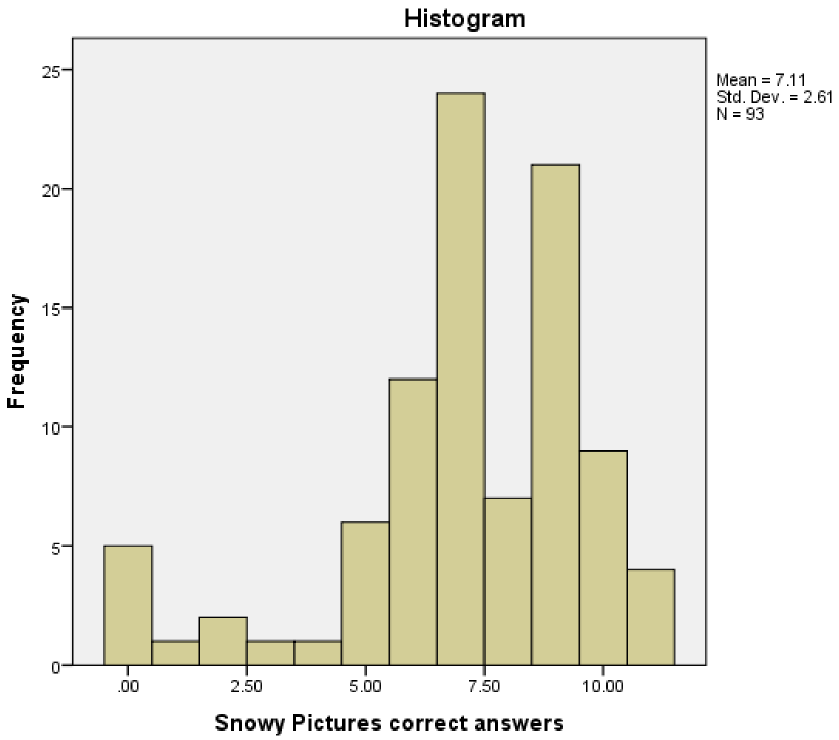
			Statistic	Std. Error
	Interquartile Range		4.00	
	Skewness		.536	.250
	Kurtosis		-.471	.495
Snowy Pictures Attempt Made but Incorrect	Mean		4.3548	.24731
	95% Confidence Interval for Mean	Lower Bound	3.8637	
		Upper Bound	4.8460	
	5% Trimmed Mean		4.2628	
	Median		5.0000	
	Variance		5.688	
	Std. Deviation		2.38494	
	Minimum		.00	
	Maximum		13.00	
	Range		13.00	
	Interquartile Range		3.00	
	Skewness		.639	.250
	Kurtosis		1.372	.495
Snowy Pictures None Correct	Mean		8.0430	.31664
	95% Confidence Interval for Mean	Lower Bound	7.4141	
		Upper Bound	8.6719	
	5% Trimmed Mean		8.2700	
	Median		8.0000	
	Variance		9.324	
	Std. Deviation		3.05356	
	Minimum		.00	
	Maximum		12.00	
	Range		12.00	
	Interquartile Range		4.50	
	Skewness		-.912	.250
	Kurtosis		.602	.495

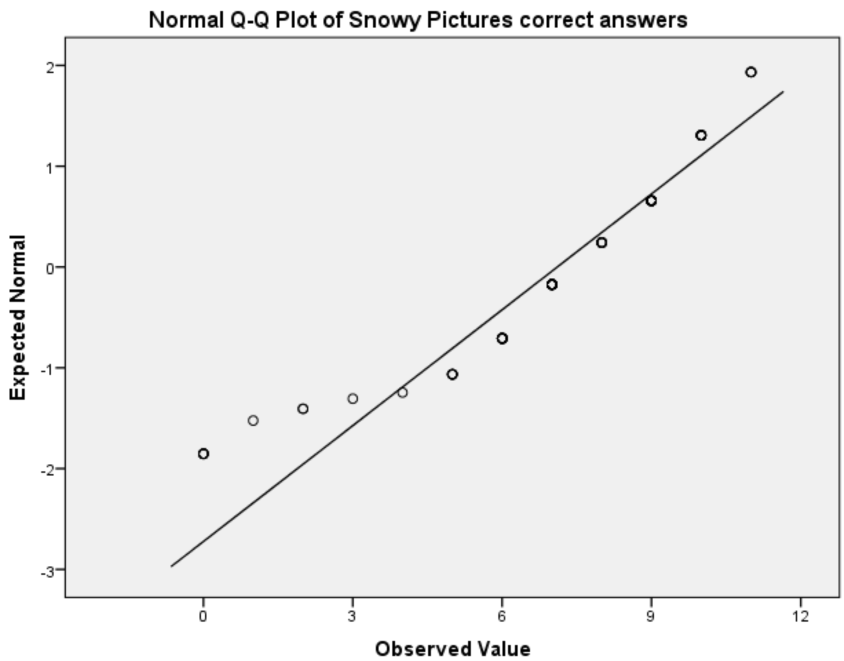
Tests of Normality

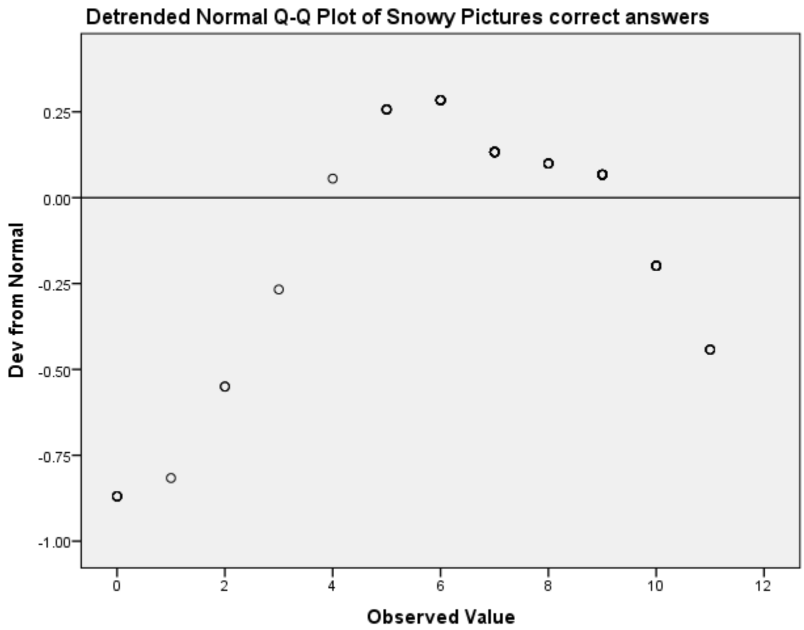
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Snowy Pictures correct answers	.182	93	.000	.881	93	.000
Snowy Pictures False Positives	.138	93	.000	.936	93	.000
Snowy Pictures Attempt Made but Incorrect	.134	93	.000	.949	93	.001
Snowy Pictures None Correct	.137	93	.000	.911	93	.000

a. Lilliefors Significance Correction

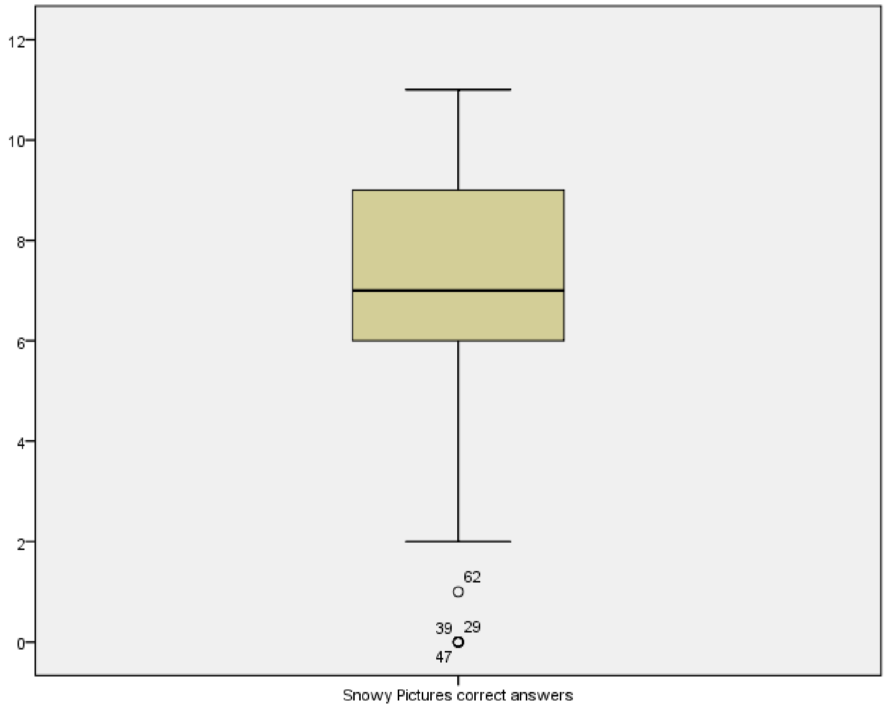
Snowy Pictures correct answers





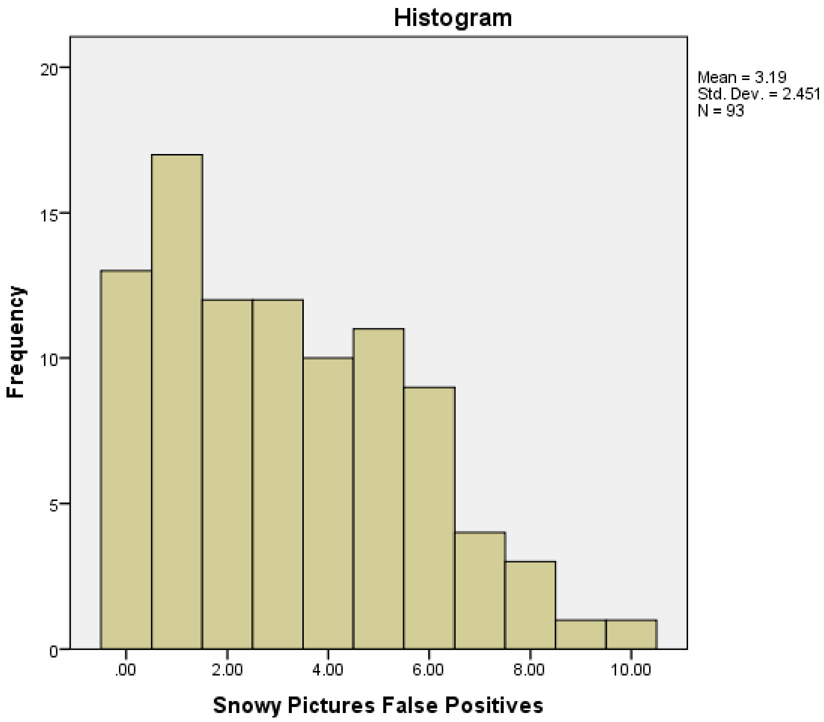


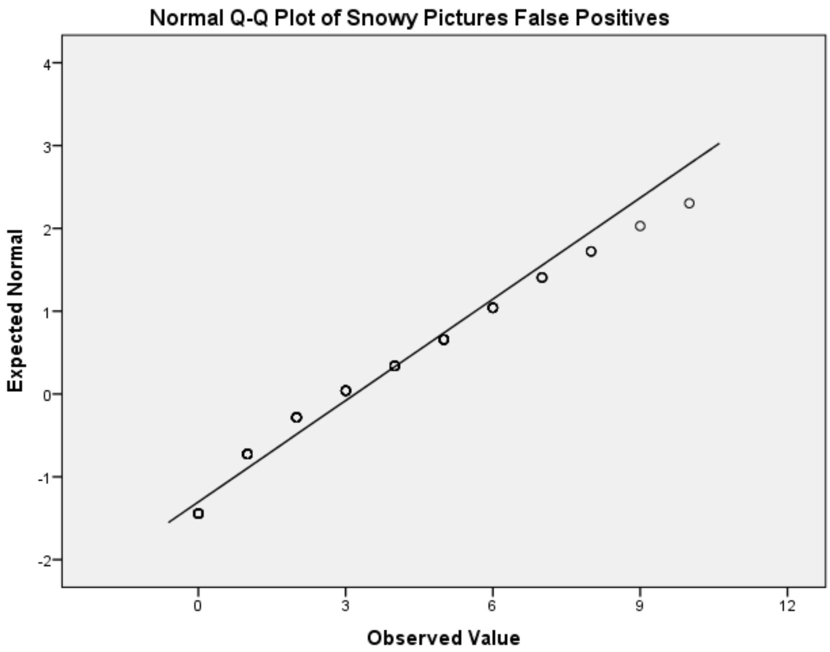
Detrended Normal Q-Q Plot of Snowy Pictures correct answers
Dev from Normal
0.25
0.00
-0.25
-0.50
-0.75
-1.00
0
2
4
6
8
10
12
Observed Value

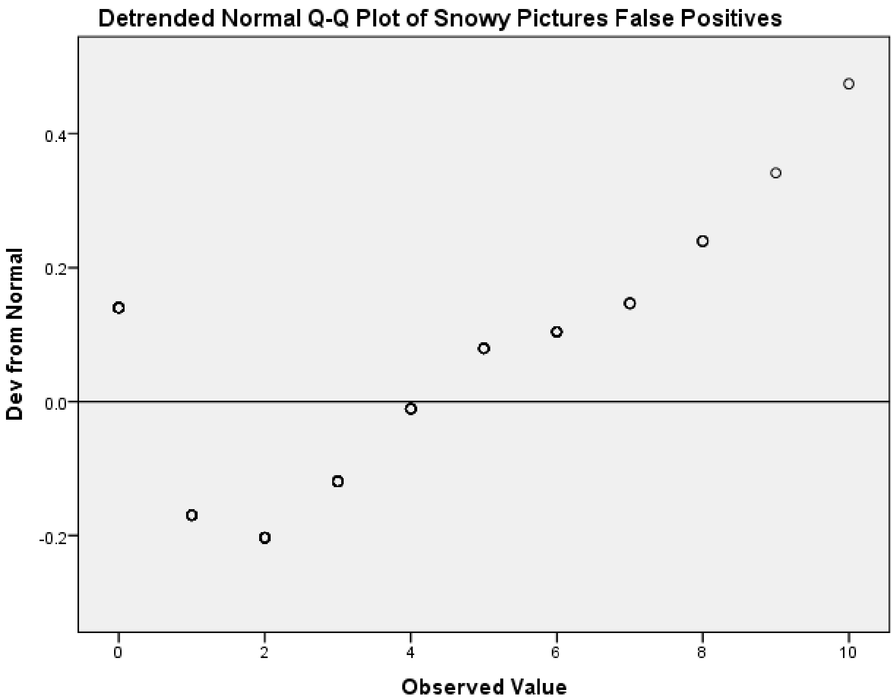


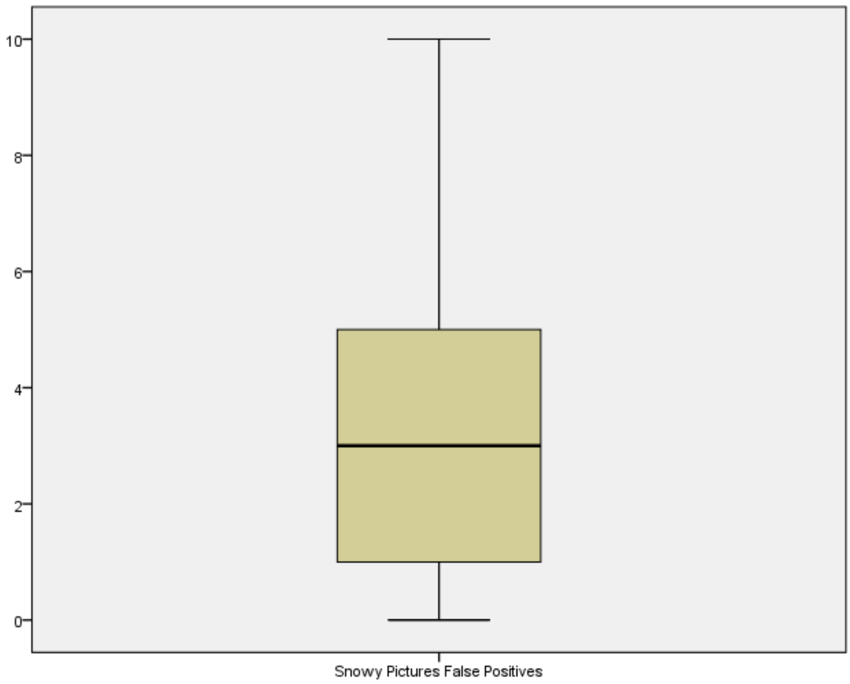
12
10
8
6
4
2
0
62
39
29
47
Snowy Pictures correct answers

Snowy Pictures False Positives

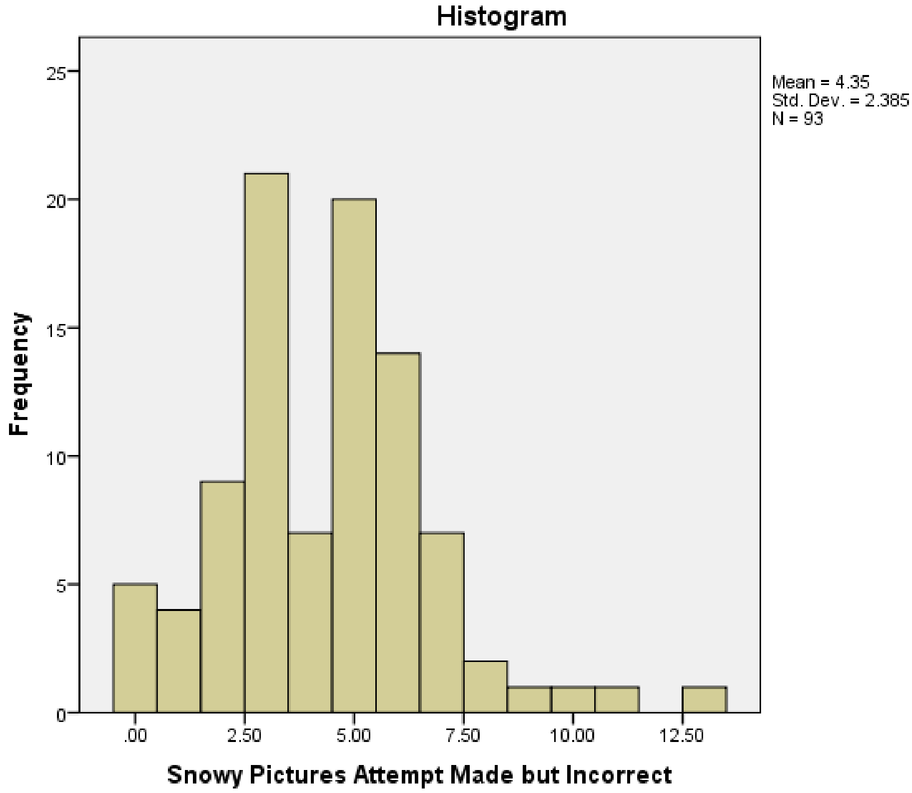


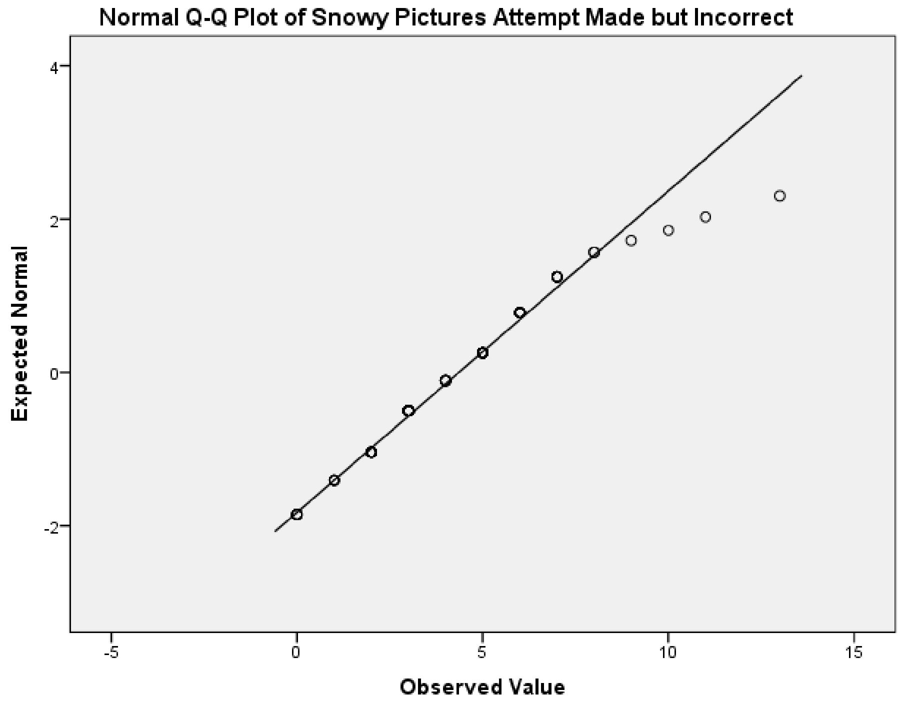


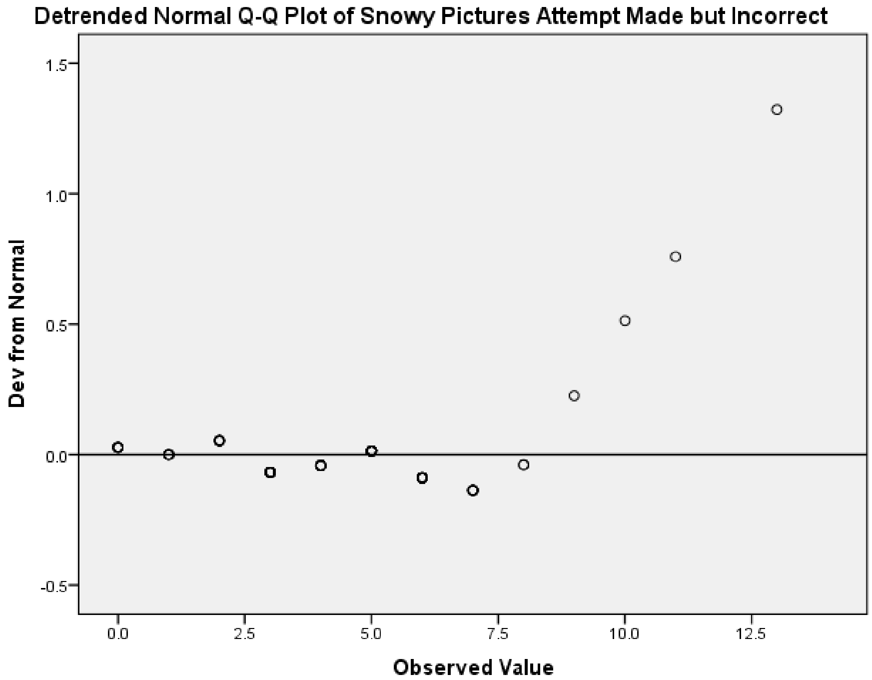

Detrended Normal Q-Q Plot of Snowy Pictures False Positives
Dev from Normal
Observed Value
0.4
0.2
0.0
-0.2
0
2
4
6
8
10

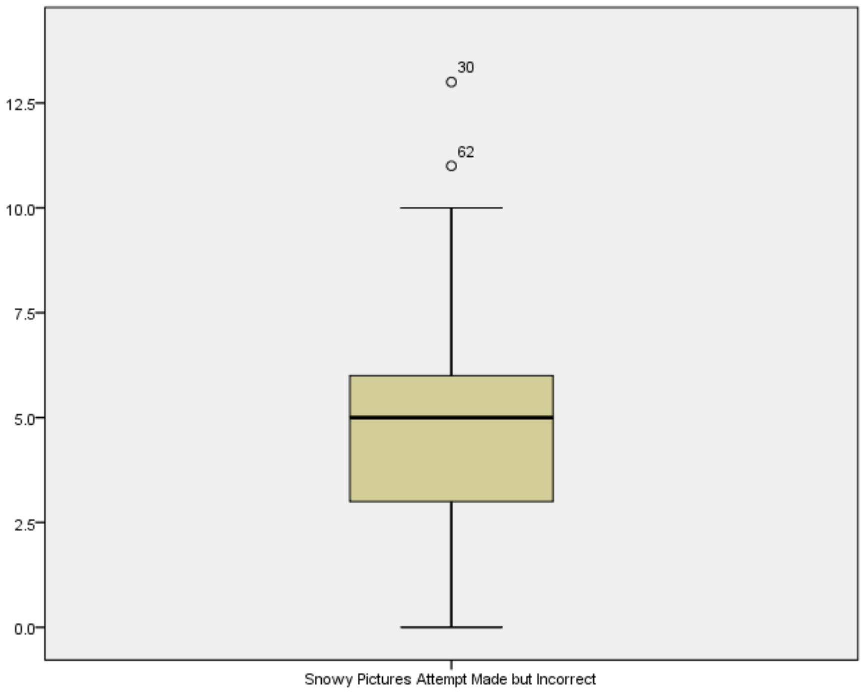

10
8
6
4
2
0
Snowy Pictures False Positives

Snowy Pictures Attempt Made but Incorrect

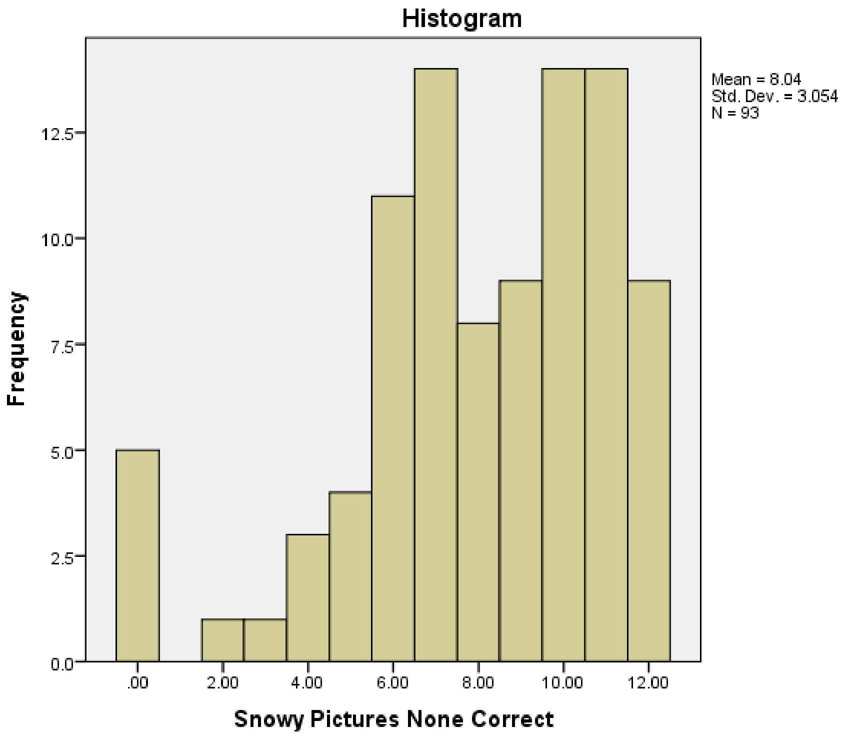


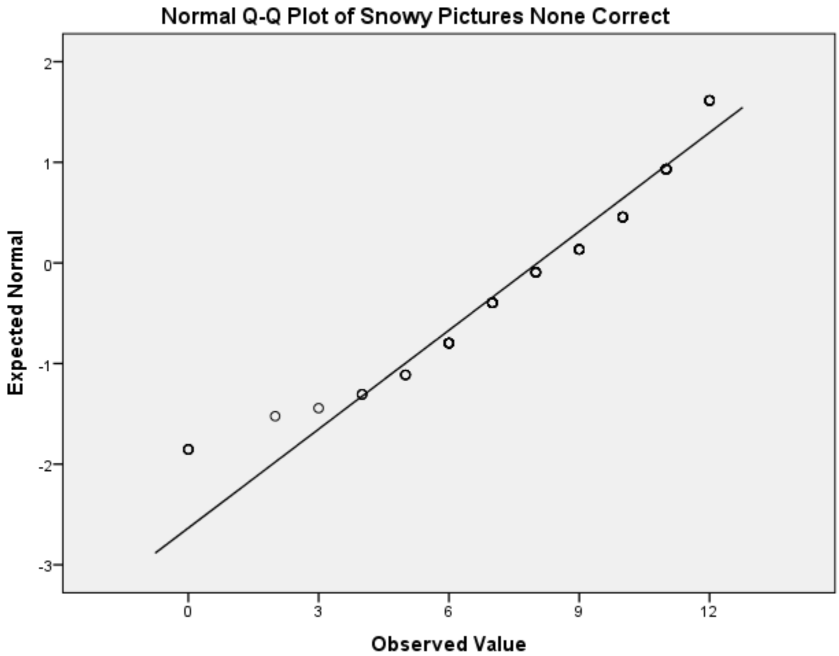


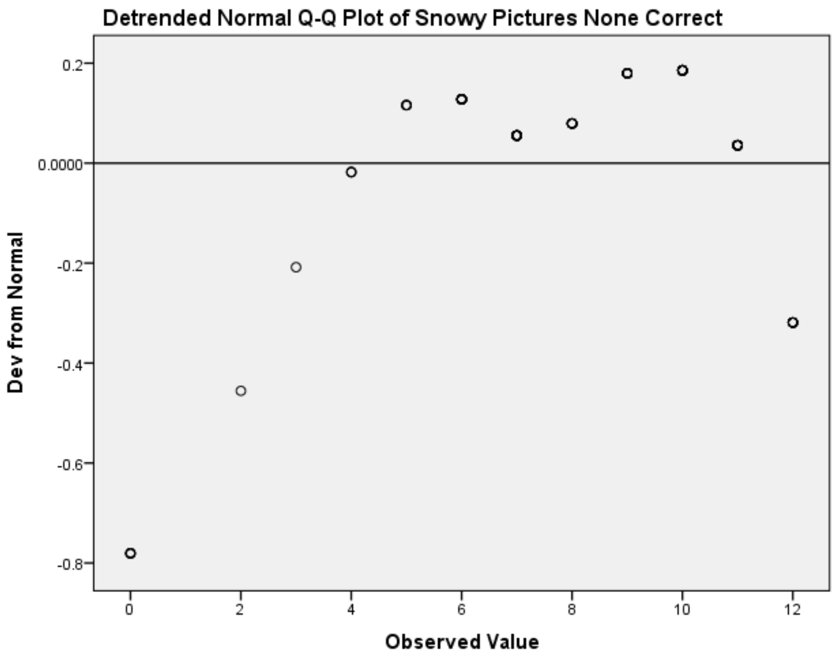

Detrended Normal Q-Q Plot of Snowy Pictures Attempt Made but Incorrect
Dev from Normal
1.5
1.0
0.5
0.0
-0.5
0.0
2.5
5.0
7.5
10.0
12.5
Observed Value

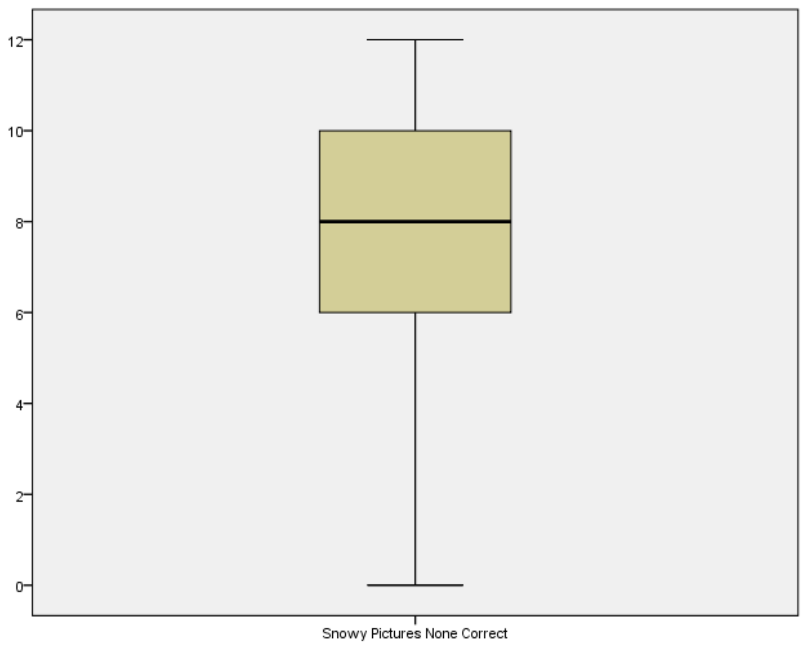

30
62
12.5
10.0
7.5
5.0
2.5
0.0
Snowy Pictures Attempt Made but Incorrect

Snowy Pictures None Correct






Detrended Normal Q-Q Plot of Snowy Pictures None Correct
Dev from Normal
Observed Value
0.2
0.0000
-0.2
-0.4
-0.6
-0.8
0
2
4
6
8
10
12


12
10
8
6
4
2
0
Snowy Pictures None Correct

NPar Tests

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
Snowy Pictures Attempt Made but Incorrect	93	4.3548	2.38494	.00	13.00
Snowy Pictures None Correct	93	8.0430	3.05356	.00	12.00
Snowy Pictures correct answers	93	7.1075	2.61044	.00	11.00
Snowy Pictures False Positives	93	3.1935	2.45063	.00	10.00
PDI_Group	93	1.4946	.50268	1.00	2.00

Mann-Whitney Test

Ranks

	PDI_Group	N	Mean Rank	Sum of Ranks
Snowy Pictures Attempt Made but Incorrect	Low	47	42.19	1983.00
	High	46	51.91	2388.00
	Total	93		
Snowy Pictures None Correct	Low	47	46.90	2204.50
	High	46	47.10	2166.50
	Total	93		
Snowy Pictures correct answers	Low	47	47.46	2230.50
	High	46	46.53	2140.50
	Total	93		
Snowy Pictures False Positives	Low	47	41.56	1953.50
	High	46	52.55	2417.50
	Total	93		

Test Statistics[a]

	Snowy Pictures Attempt Made but Incorrect	Snowy Pictures None Correct	Snowy Pictures correct answers	Snowy Pictures False Positives
Mann-Whitney U	855.000	1076.500	1059.500	825.500
Wilcoxon W	1983.000	2204.500	2140.500	1953.500
Z	-1.760	-.035	-.168	-1.980
Asymp. Sig. (2-tailed)	.078	.972	.867	.048

a. Grouping Variable: PDI_Group

Chapter 5

Explore

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Narratives_overall	80	66.1%	41	33.9%	121	100.0%

Descriptives

			Statistic	Std. Error
Narratives_overall	Mean		4.3988	.09452
	95% Confidence Interval for Mean	Lower Bound	4.2106	
		Upper Bound	4.5869	
	5% Trimmed Mean		4.3866	
	Median		4.3333	
	Variance		.715	
	Std. Deviation		.84545	
	Minimum		2.55	
	Maximum		6.50	
	Range		3.95	
	Interquartile Range		1.17	
	Skewness		.250	.269
	Kurtosis		-.168	.532

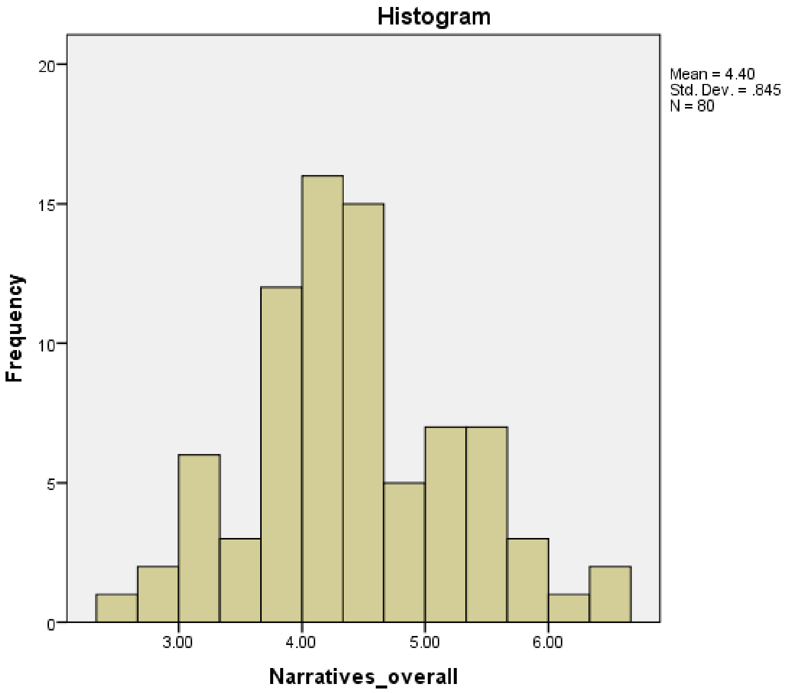
Tests of Normality

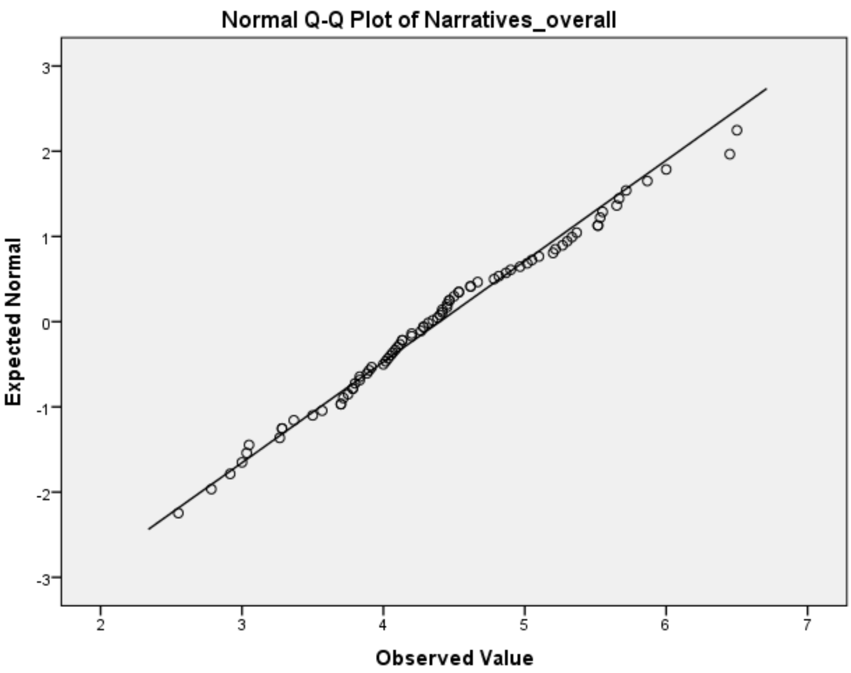
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Narratives_overall	.087	80	.200*	.987	80	.581

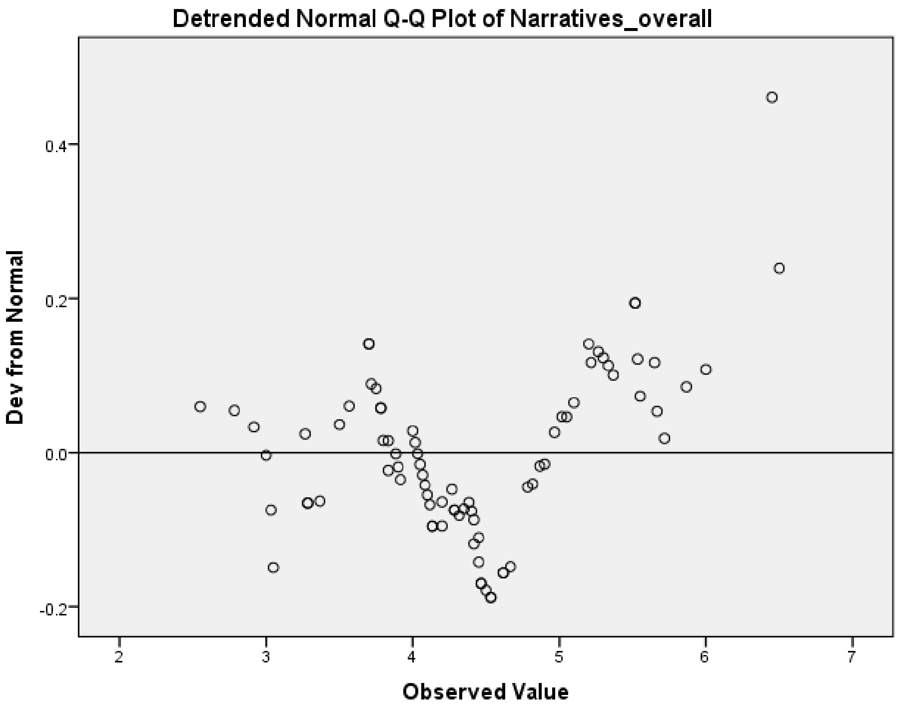
*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

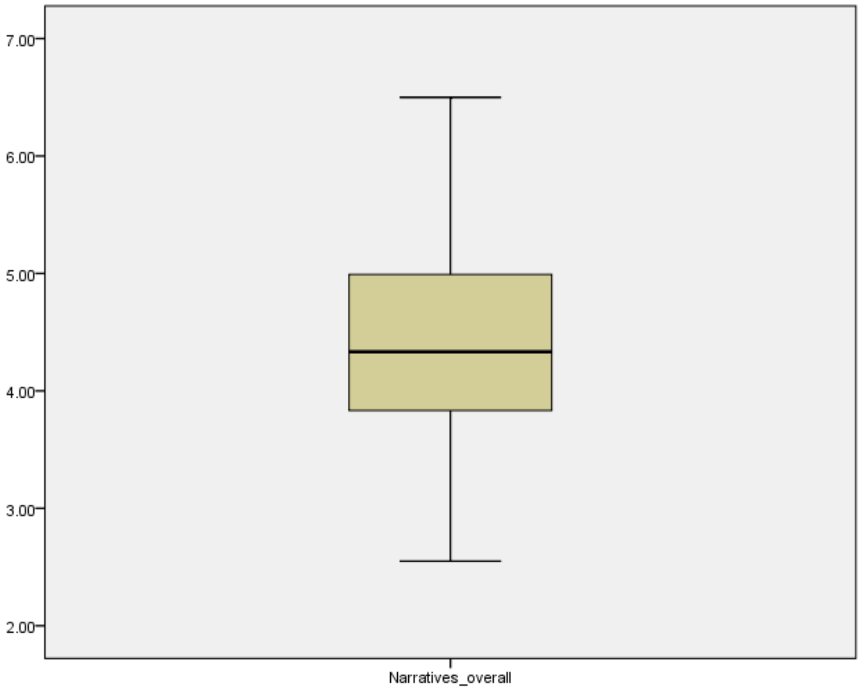
Narratives_overall







Detrended Normal Q-Q Plot of Narratives_overall
Dev from Normal
0.4
0.2
0.0
-0.2
2
3
4
5
6
7
Observed Value



7.00
6.00
5.00
4.00
3.00
2.00
Narratives_overall

Bridge the Associate Gap task

Explore

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Word_occurrence_related_unique	84	69.4%	37	30.6%	121	100.0%
Word_occurence_related_rare	84	69.4%	37	30.6%	121	100.0%
Word_occurance_related_common	84	69.4%	37	30.6%	121	100.0%
Word_occurrence_unrelated_unique	84	69.4%	37	30.6%	121	100.0%
Word_occurance_unrelated_rare	84	69.4%	37	30.6%	121	100.0%
Word_occurrence_unrelated_common	84	69.4%	37	30.6%	121	100.0%

Descriptives

			Statistic	Std. Error
Word_occurrence_related_unique	Mean		1.6429	.18135
	95% Confidence Interval for Mean	Lower Bound	1.2822	
		Upper Bound	2.0035	
	5% Trimmed Mean		1.4947	
	Median		1.0000	
	Variance		2.762	
	Std. Deviation		1.66207	
	Minimum		.00	
	Maximum		7.00	
	Range		7.00	
	Interquartile Range		3.00	
	Skewness		1.106	.263
	Kurtosis		.804	.520
Word_occurence_related_rare	Mean		1.3810	.13218
	95% Confidence Interval for Mean	Lower Bound	1.1181	
		Upper Bound	1.6439	
	5% Trimmed Mean		1.2751	

	Median		1.0000	
	Variance		1.468	
	Std. Deviation		1.21144	
	Minimum		.00	
	Maximum		5.00	
	Range		5.00	
	Interquartile Range		1.75	
	Skewness		1.015	.263
	Kurtosis		1.119	.520
Word_occurance_related_common	Mean		6.8929	.20184
	95% Confidence Interval for Mean	Lower Bound	6.4914	
		Upper Bound	7.2943	
	5% Trimmed Mean		6.9762	
	Median		7.0000	
	Variance		3.422	
	Std. Deviation		1.84990	
	Minimum		2.00	
	Maximum		10.00	
	Range		8.00	
	Interquartile Range		2.00	
	Skewness		-.553	.263
	Kurtosis		-.179	.520
Word_occurrence_unrelated_unique	Mean		3.0833	.22862
	95% Confidence Interval for Mean	Lower Bound	2.6286	
		Upper Bound	3.5381	
	5% Trimmed Mean		2.9974	
	Median		3.0000	
	Variance		4.391	
	Std. Deviation		2.09537	
	Minimum		.00	
	Maximum		9.00	
	Range		9.00	
	Interquartile Range		2.00	
	Skewness		.732	.263
	Kurtosis		.105	.520
Word_occurance_unrelated_rare	Mean		1.1548	.10910
	95% Confidence Interval for Mean	Lower Bound	.9378	
		Upper Bound	1.3718	
	5% Trimmed Mean		1.0899	
	Median		1.0000	
	Variance		1.000	

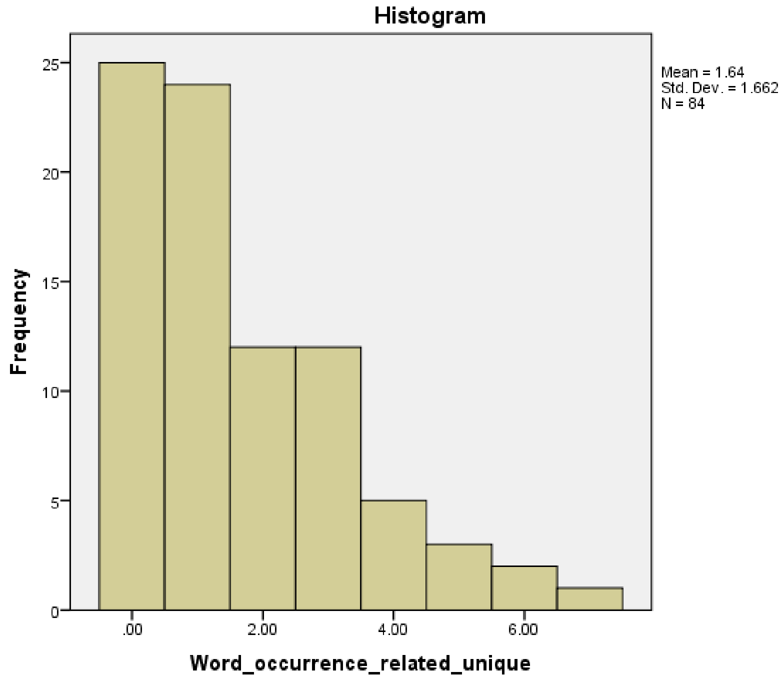
	Std. Deviation		.99993	
	Minimum		.00	
	Maximum		4.00	
	Range		4.00	
	Interquartile Range		2.00	
	Skewness		.570	.263
	Kurtosis		-.048	.520
Word_occurrence_unrelated_common	Mean		5.4524	.23124
	95% Confidence Interval for Mean	Lower Bound	4.9925	
		Upper Bound	5.9123	
	5% Trimmed Mean		5.4868	
	Median		6.0000	
	Variance		4.492	
	Std. Deviation		2.11936	
	Minimum		1.00	
	Maximum		10.00	
	Range		9.00	
	Interquartile Range		3.00	
	Skewness		-.236	.263
	Kurtosis		-.381	.520

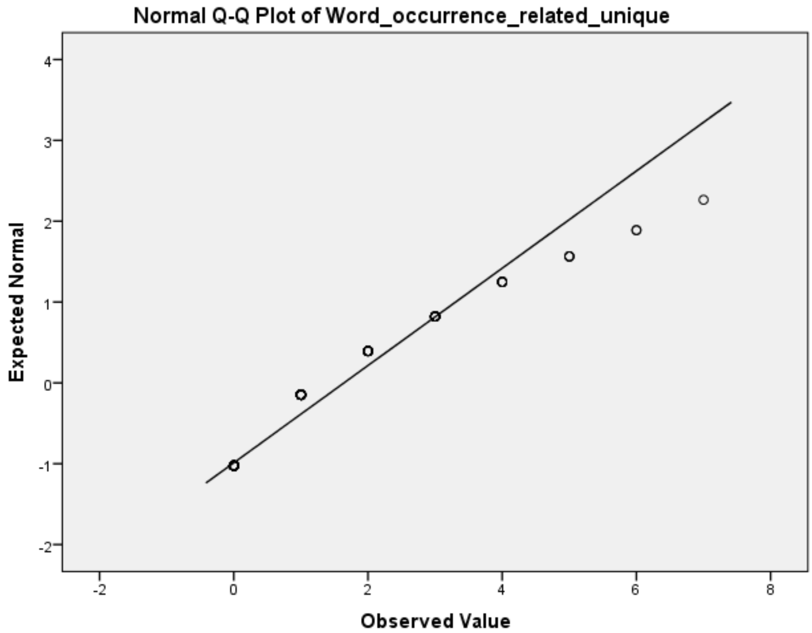
Tests of Normality

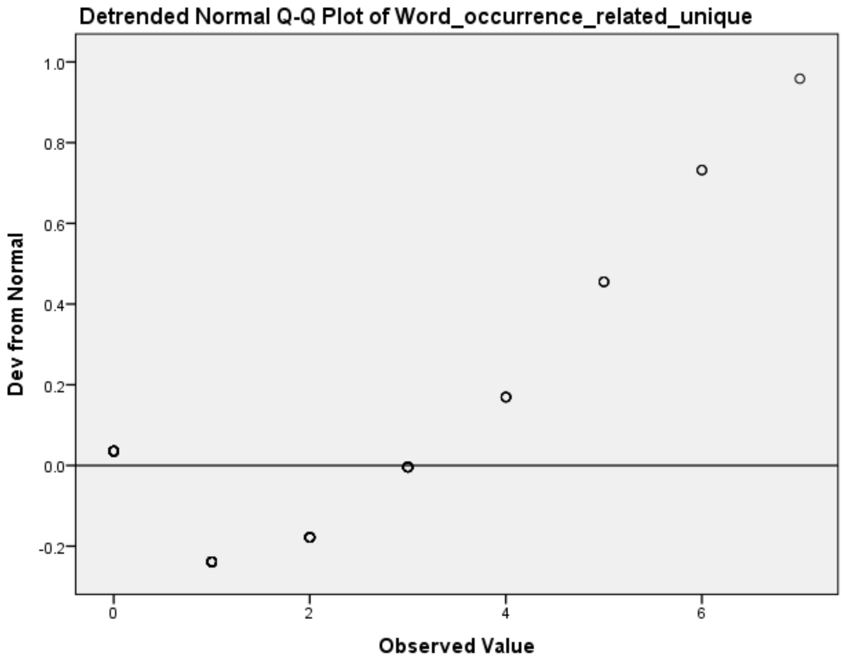
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Word_occurrence_related_unique	.234	84	.000	.857	84	.000
Word_occurence_related_rare	.231	84	.000	.863	84	.000
Word_occurance_related_common	.166	84	.000	.942	84	.001
Word_occurrence_unrelated_unique	.159	84	.000	.925	84	.000
Word_occurance_unrelated_rare	.192	84	.000	.862	84	.000
Word_occurrence_unrelated_common	.130	84	.001	.964	84	.020

a. Lilliefors Significance Correction

Word_occurrence_related_unique

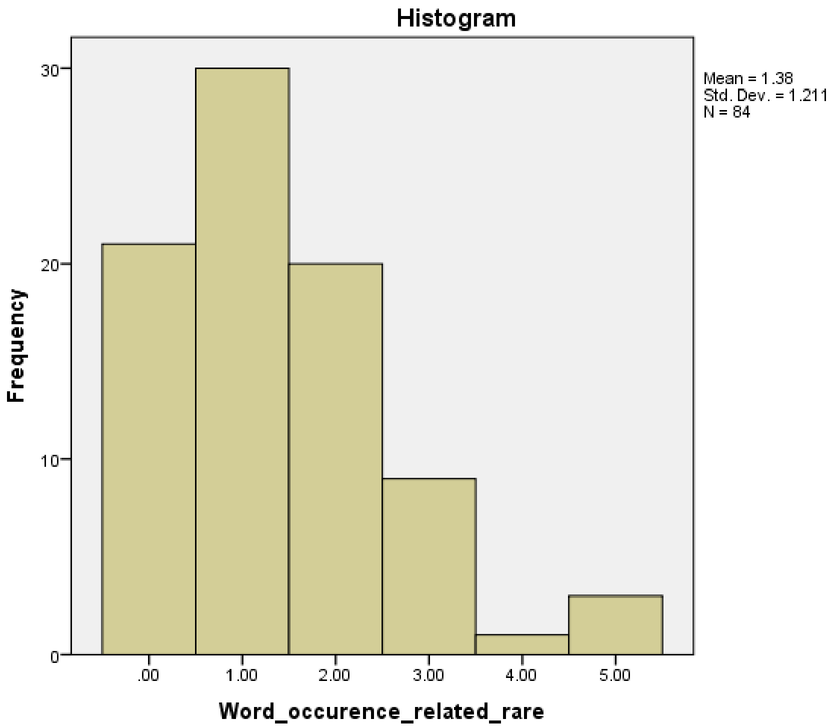


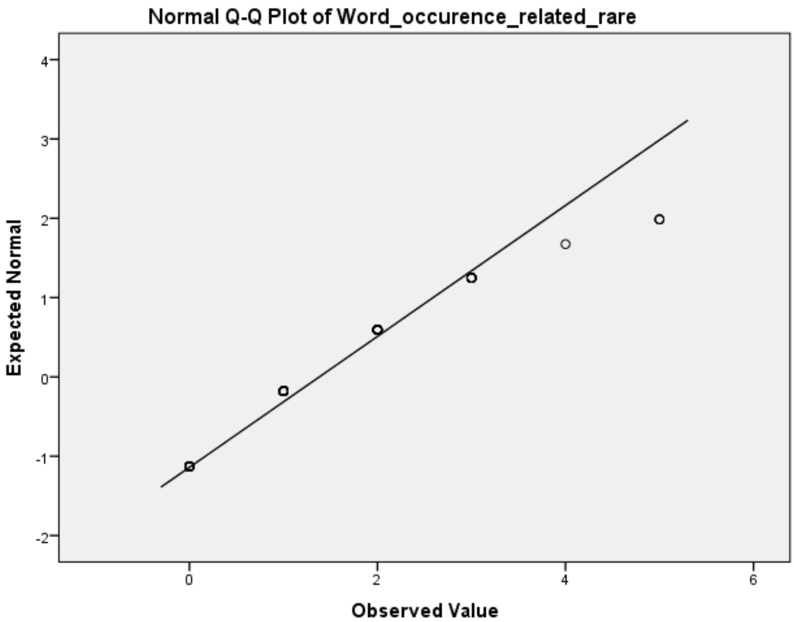


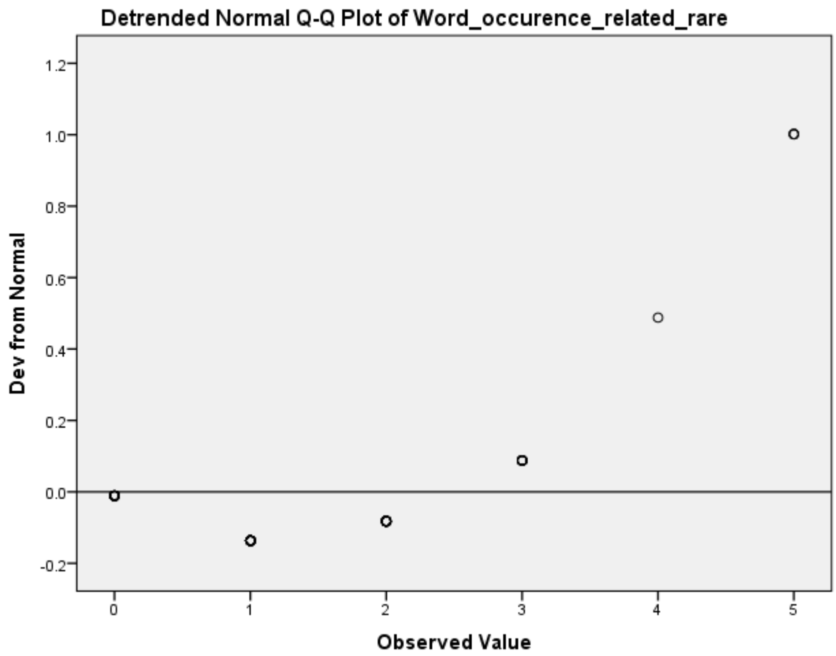

Detrended Normal Q-Q Plot of Word_occurrence_related_unique
Dev from Normal
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
0
2
4
6
Observed Value


6
4
2
0
Word_occurrence_related_unique

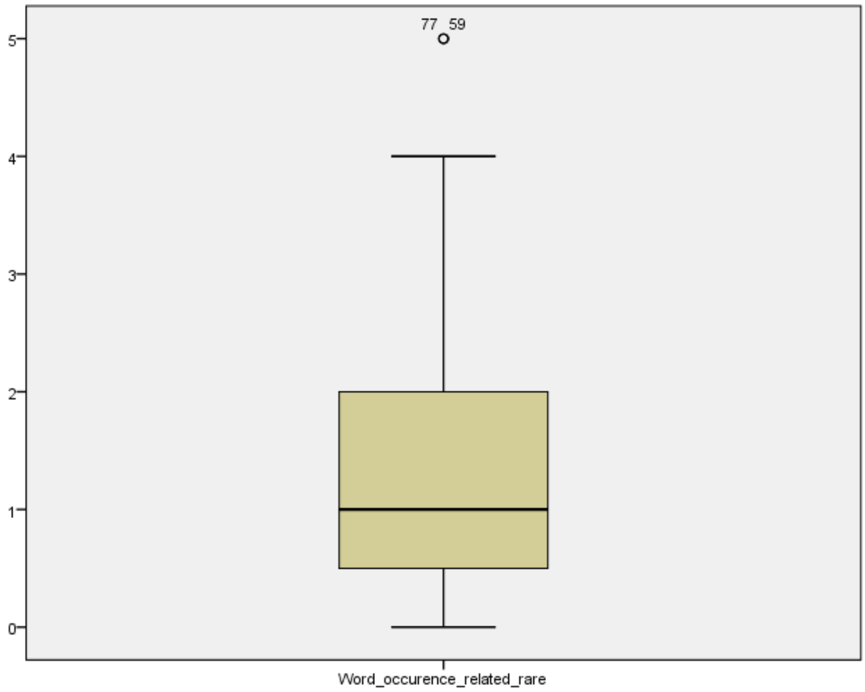
Word_occurence_related_rare





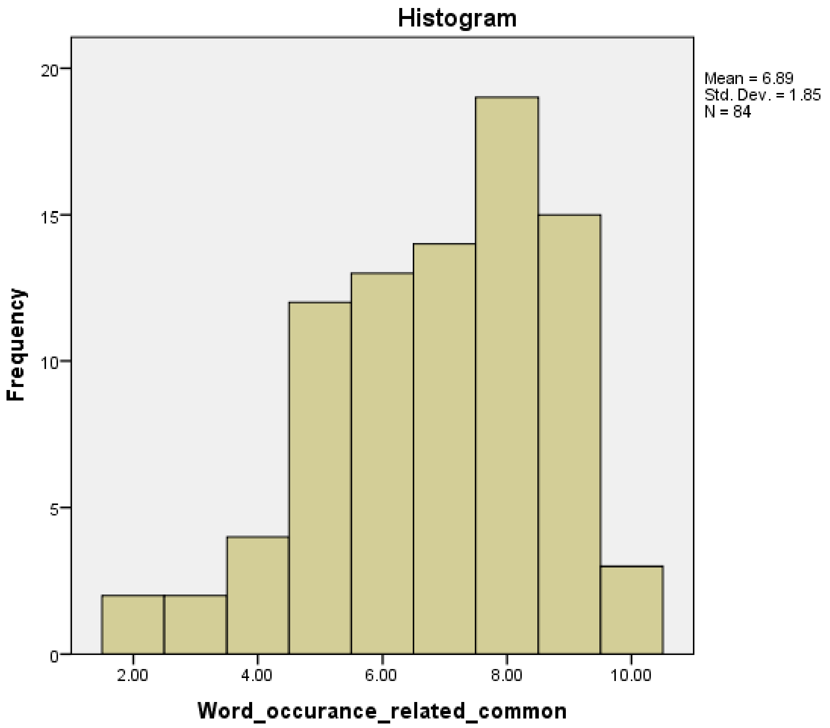


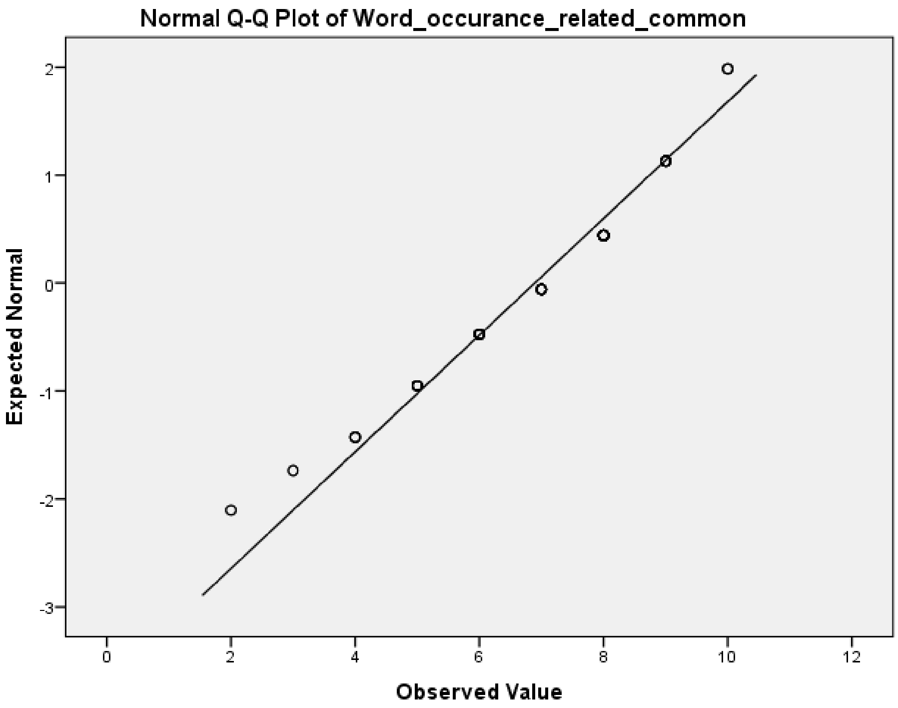
Detrended Normal Q-Q Plot of Word_occurence_related_rare
Dev from Normal
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
0
1
2
3
4
5
Observed Value

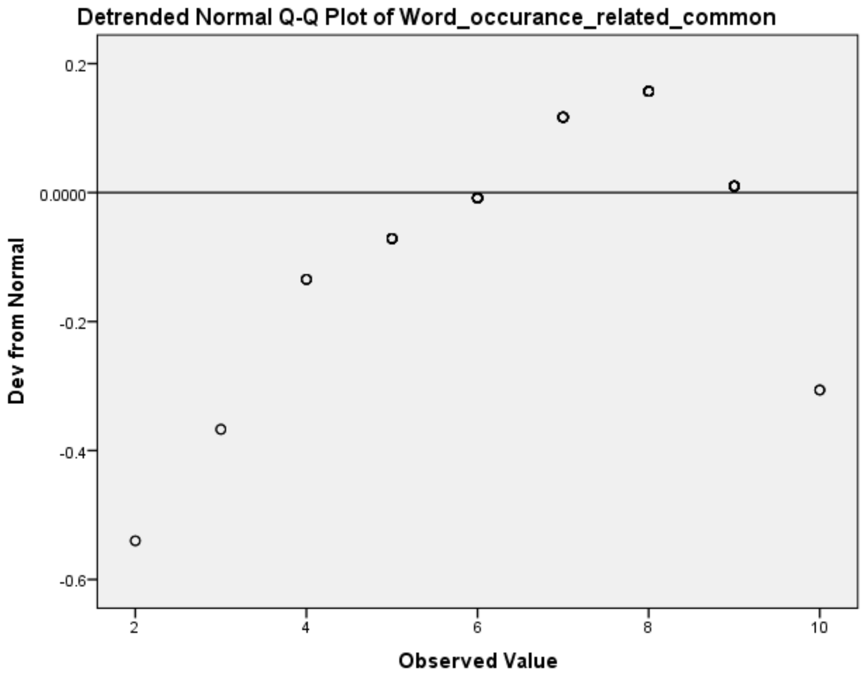


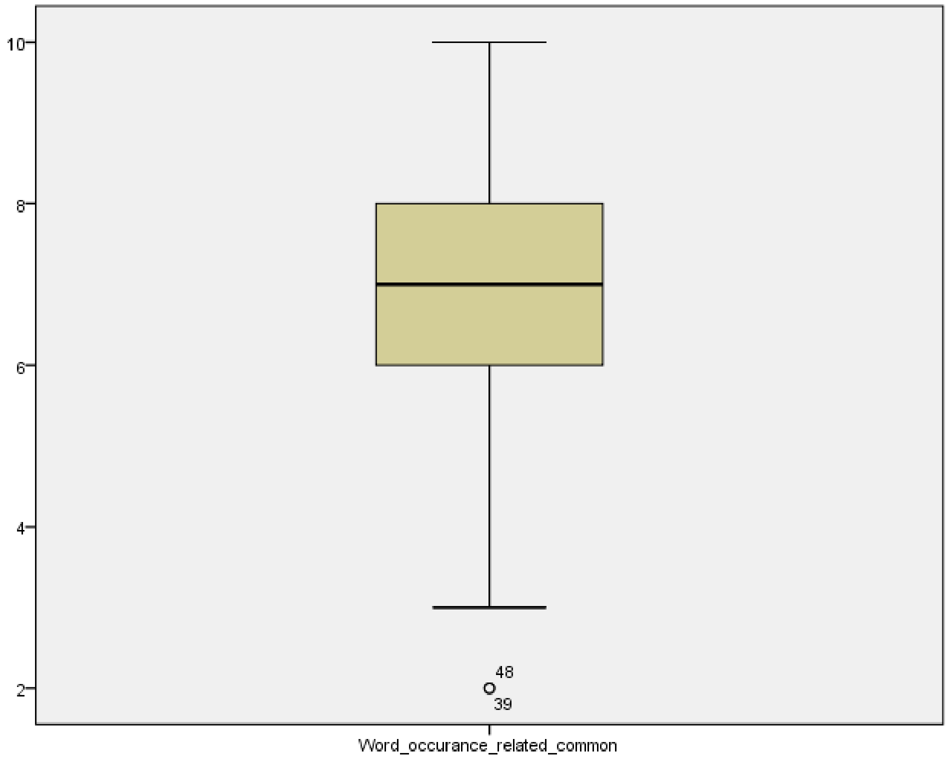
77
59
5
4
3
2
1
0
Word_occurence_related_rare

Word_occurance_related_common

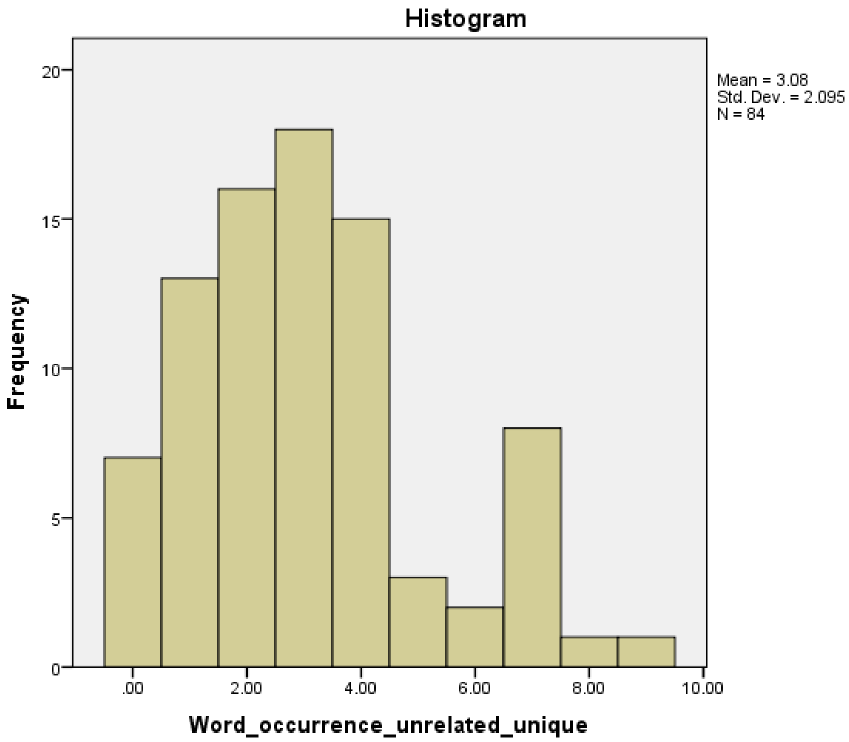


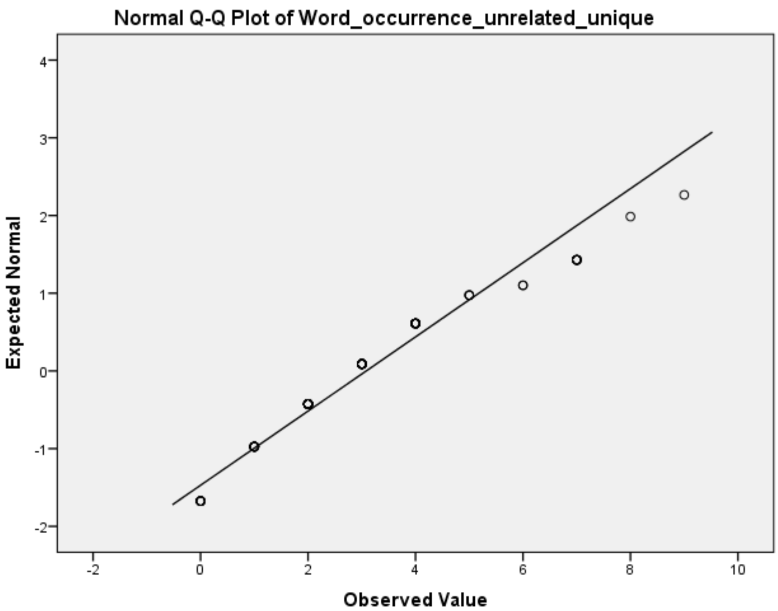


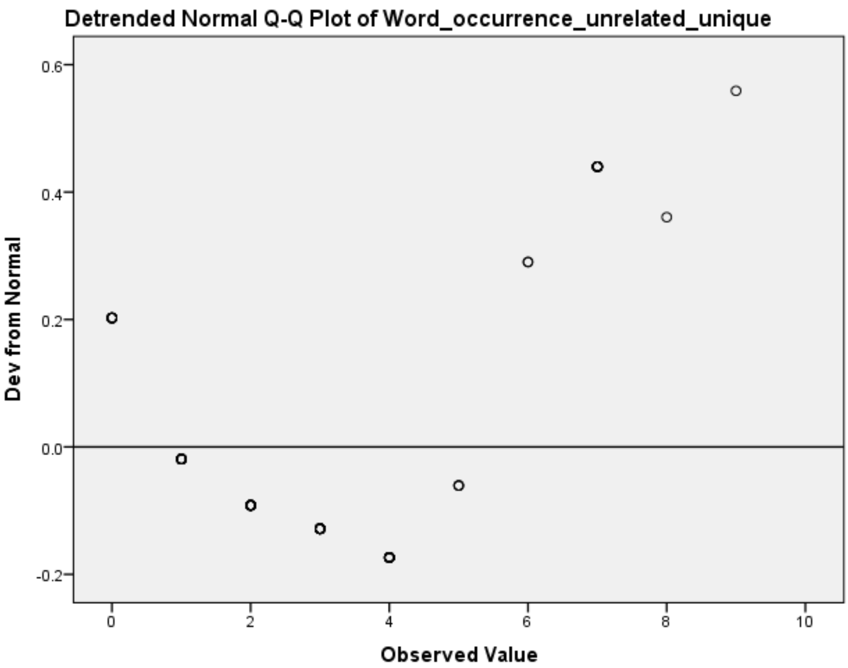

Detrended Normal Q-Q Plot of Word_occurance_related_common
Dev from Normal
0.2
0.0000
-0.2
-0.4
-0.6
2
4
6
8
10
Observed Value


10
8
6
4
2
48
39
Word_occurance_related_common

Word_occurrence_unrelated_unique

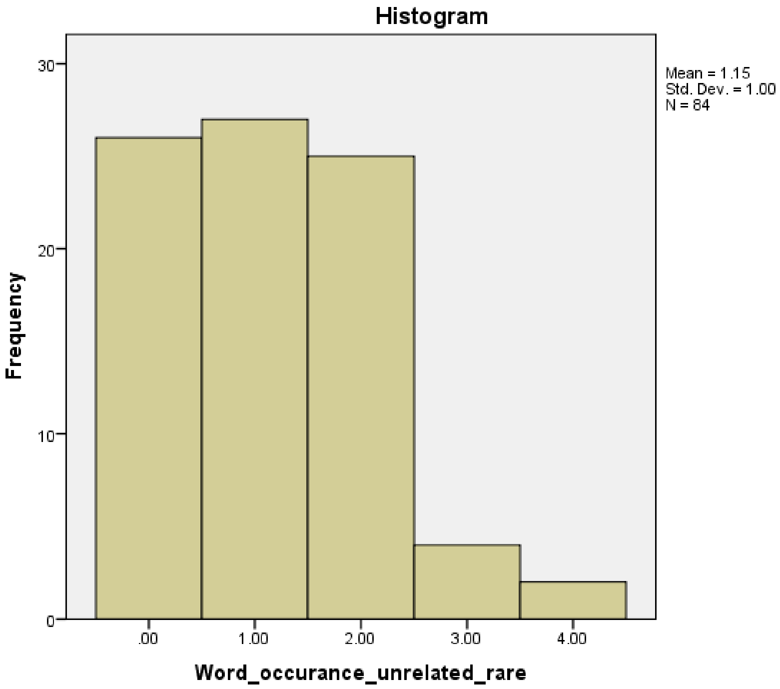


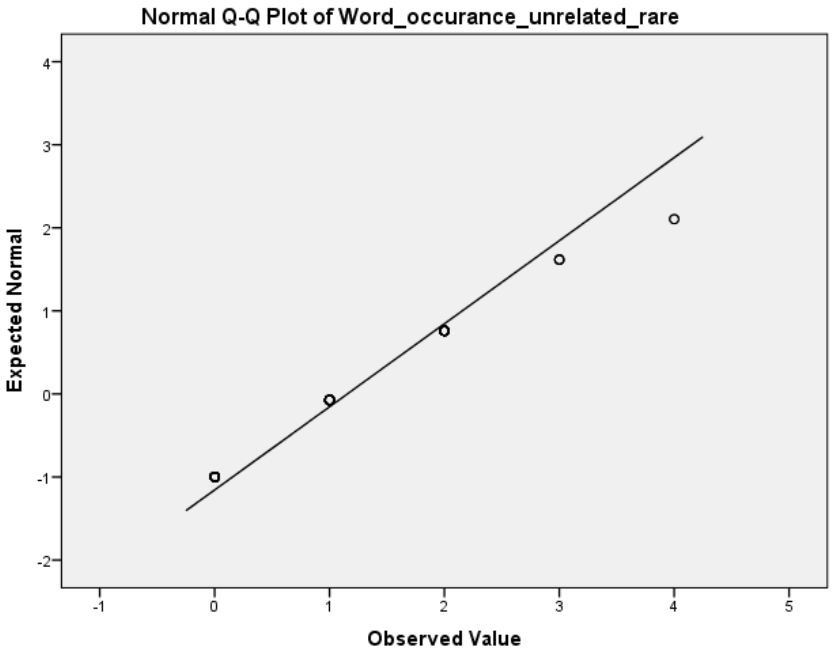


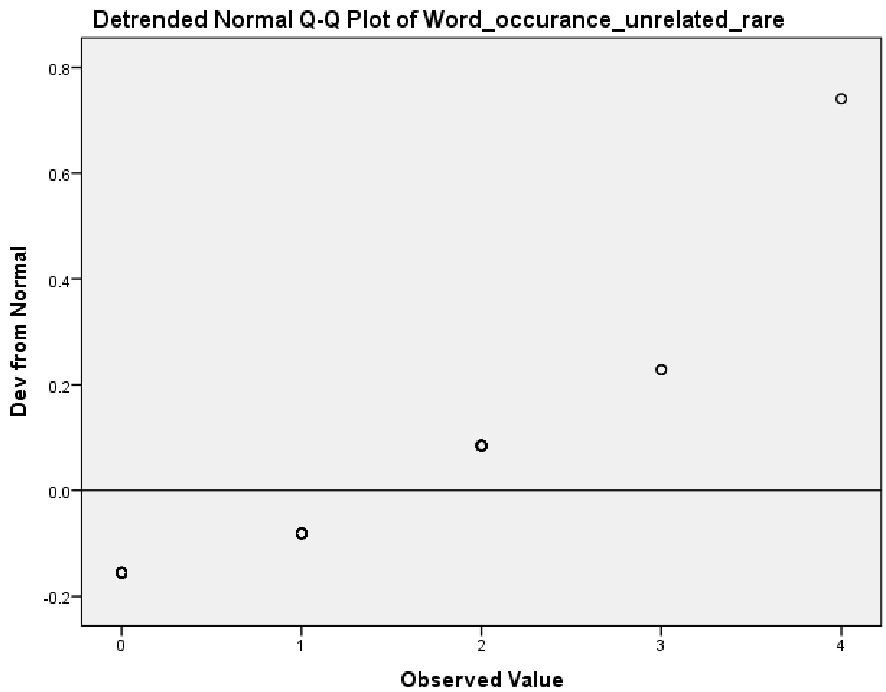

Detrended Normal Q-Q Plot of Word_occurrence_unrelated_unique
Dev from Normal
Observed Value
0.6
0.4
0.2
0.0
-0.2
0
2
4
6
8
10

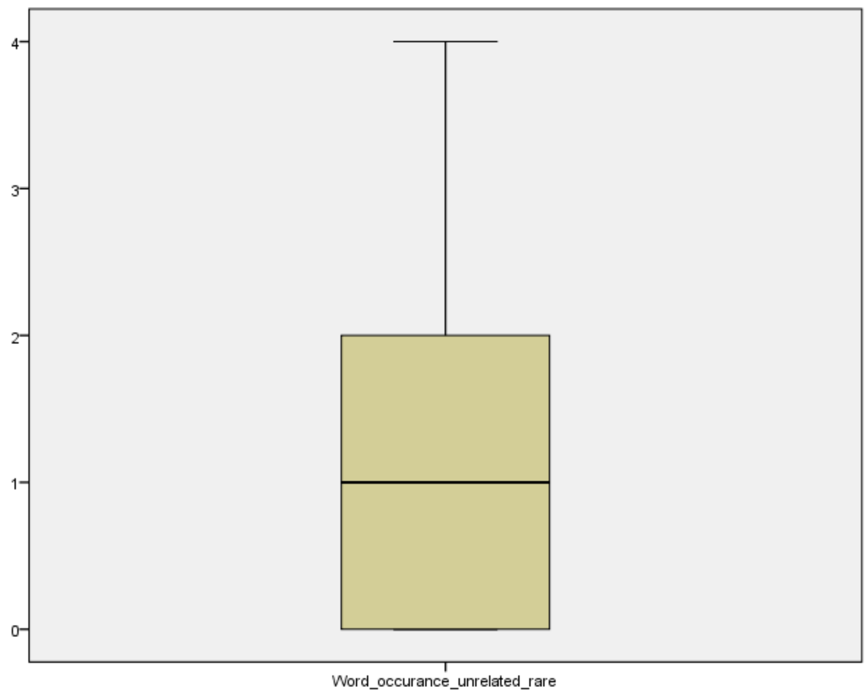

72
39
10
8
6
4
2
0
Word_occurrence_unrelated_unique

Word_occurance_unrelated_rare

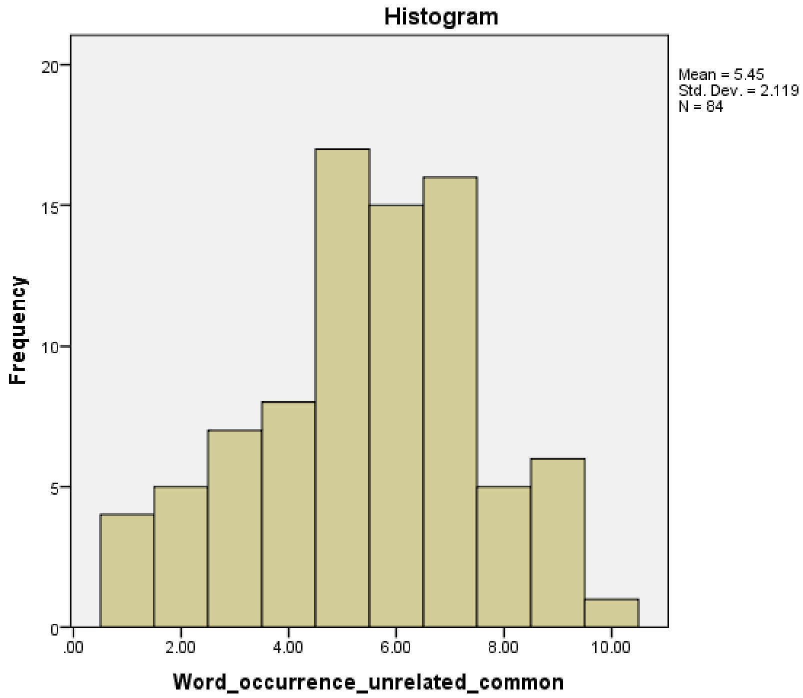


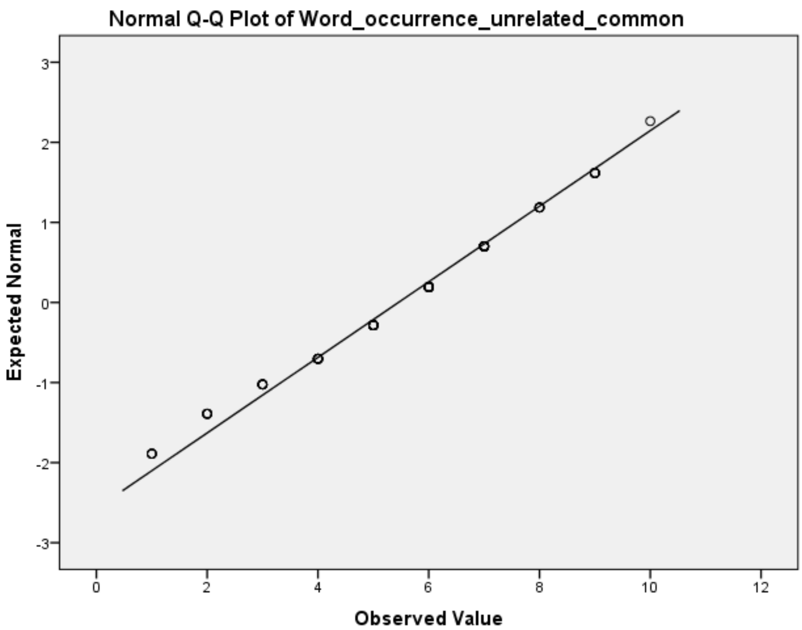


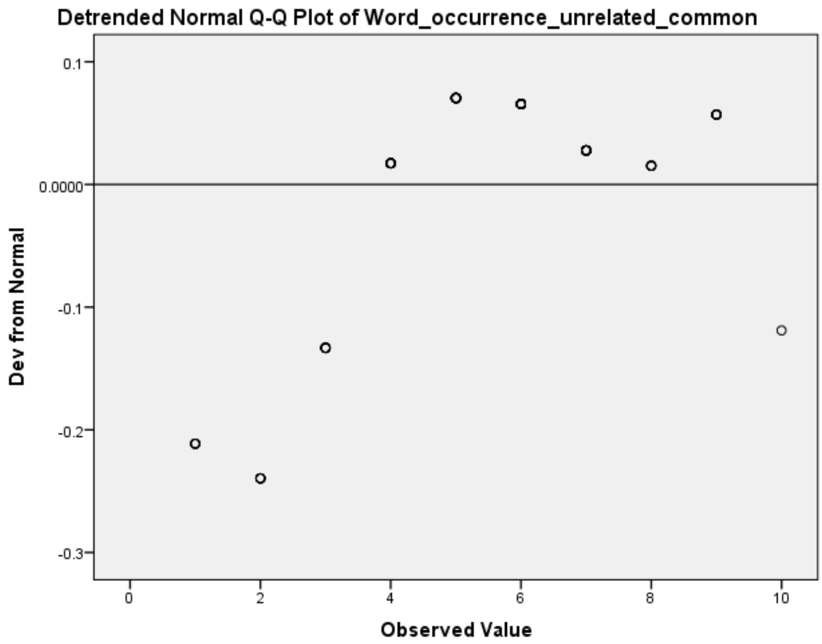

Detrended Normal Q-Q Plot of Word_occurance_unrelated_rare
Dev from Normal
Observed Value
0.8
0.6
0.4
0.2
0.0
-0.2
0
1
2
3
4

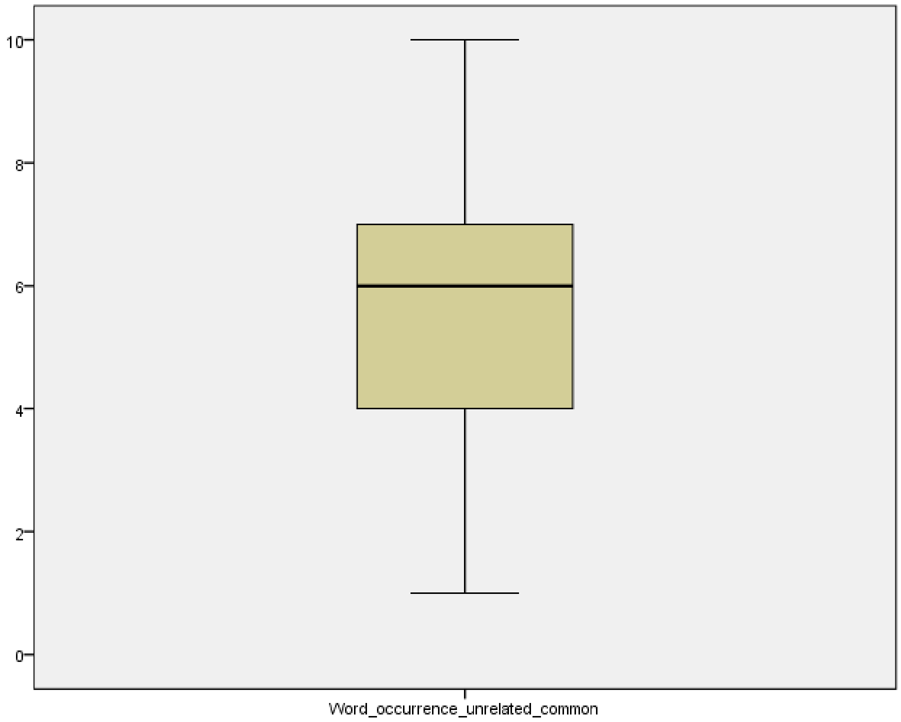

4
3
2
1
0
Word_occurance_unrelated_rare

Word_occurrence_unrelated_common






Detrended Normal Q-Q Plot of Word_occurrence_unrelated_common
0.1
0.0000
-0.1
-0.2
-0.3
Dev from Normal
0
2
4
6
8
10
Observed Value


10
8
6
4
2
0
Word_occurrence_unrelated_common

Coincidences

Explore

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Total_coincidences	84	69.4%	37	30.6%	121	100.0%

Descriptives

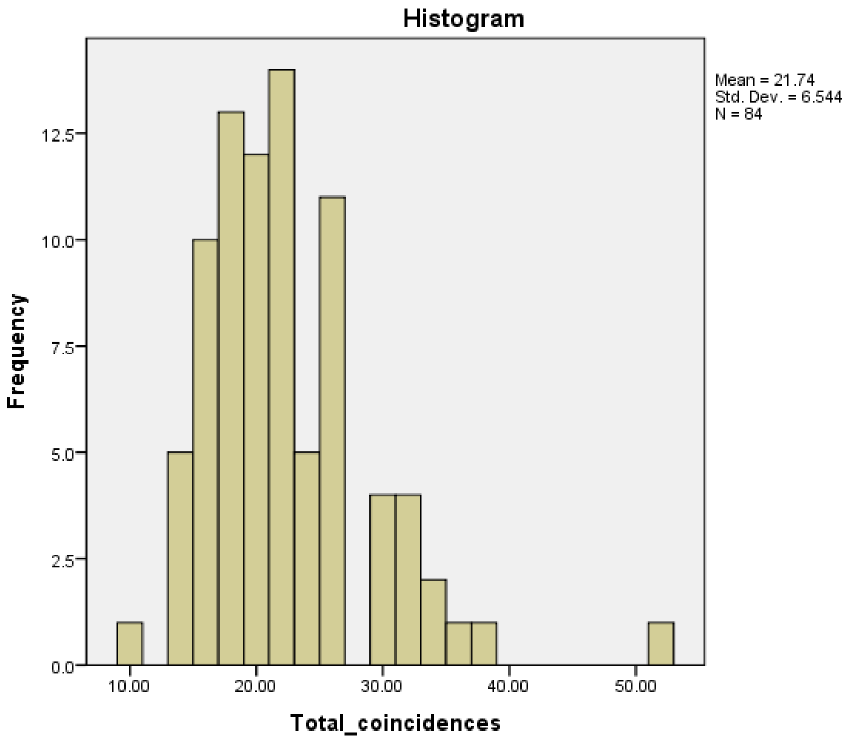
			Statistic	Std. Error
Total_coincidences	Mean		21.7381	.71399
	95% Confidence Interval for Mean	Lower Bound	20.3180	
		Upper Bound	23.1582	
	5% Trimmed Mean		21.2778	
	Median		21.0000	
	Variance		42.822	
	Std. Deviation		6.54386	
	Minimum		10.00	
	Maximum		51.00	
	Range		41.00	
	Interquartile Range		7.75	
	Skewness		1.491	.263
	Kurtosis		3.965	.520

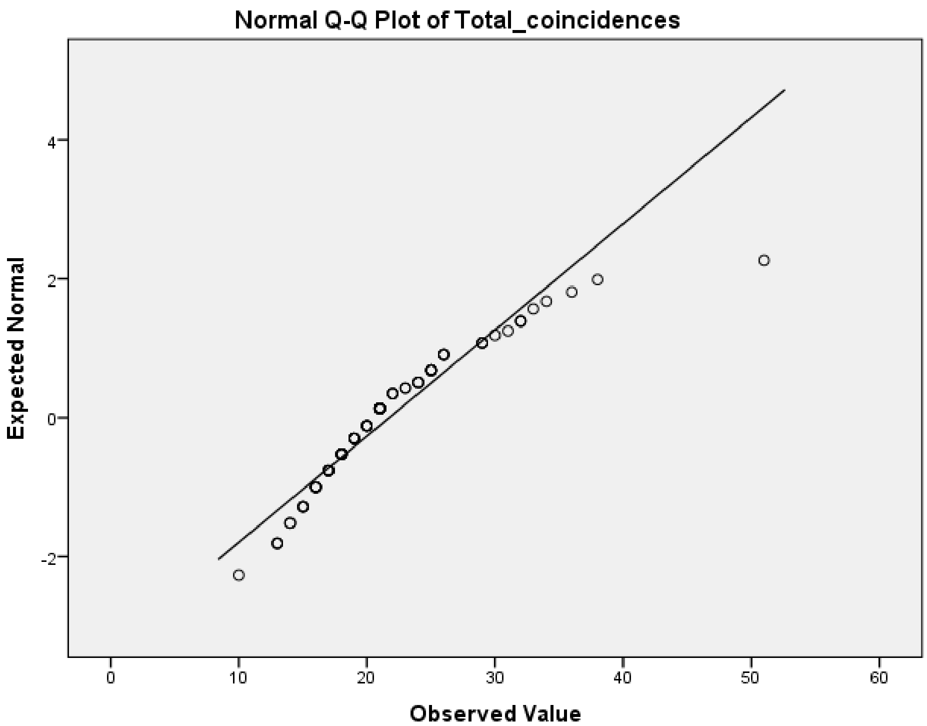
Tests of Normality

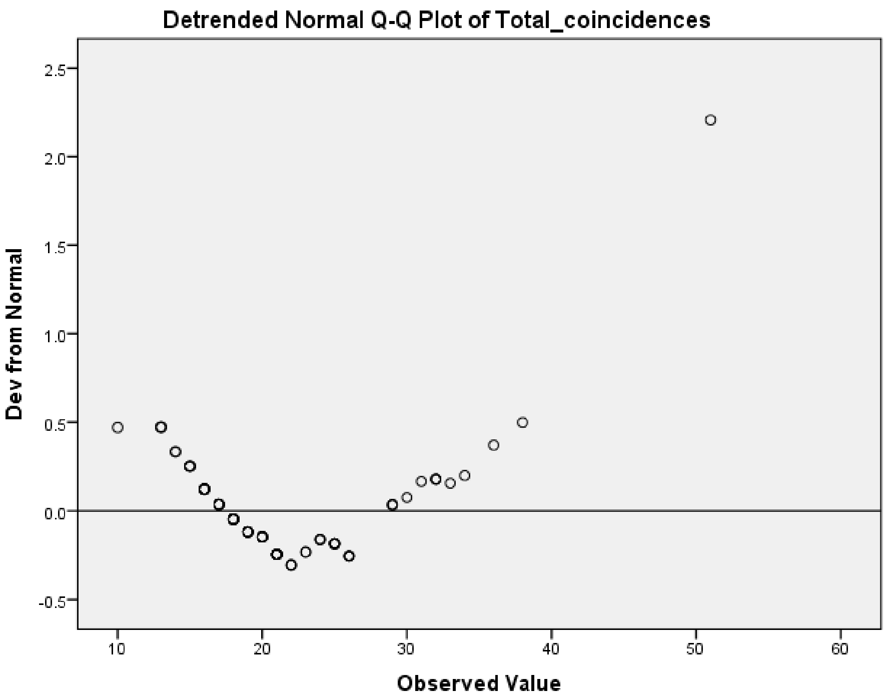
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Total_coincidences	.164	84	.000	.902	84	.000

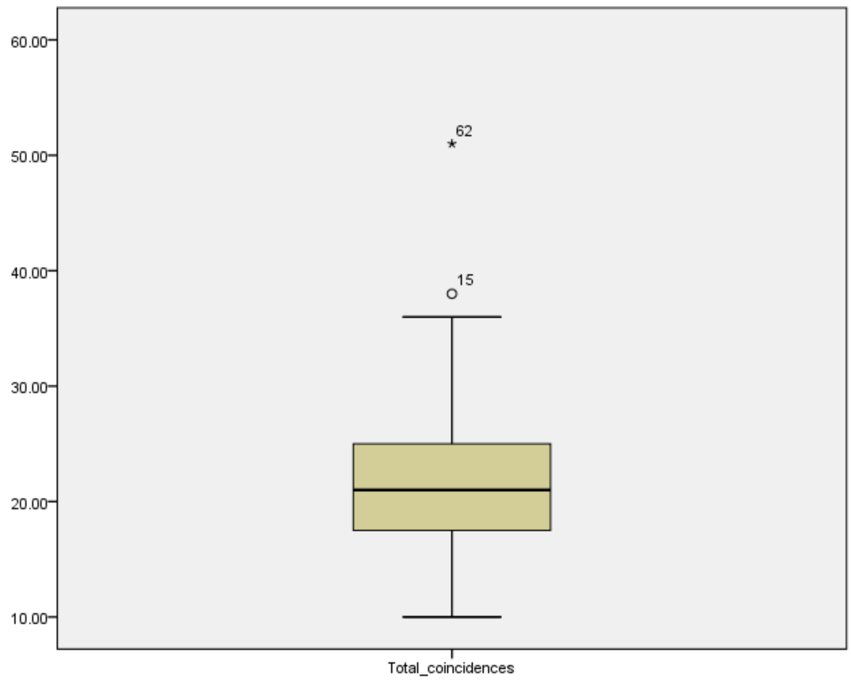
a. Lilliefors Significance Correction

Total_coincidences






Detrended Normal Q-Q Plot of Total_coincidences
Dev from Normal
Observed Value
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
10
20
30
40
50
60


60.00
50.00
40.00
30.00
20.00
10.00
62
15
Total_coincidences

NPar Tests

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
Total_coincidences	84	21.7381	6.54386	10.00	51.00
PDI_Group	83	1.4819	.50271	1.00	2.00

Mann-Whitney Test

Ranks

	PDI_Group	N	Mean Rank	Sum of Ranks
Total_coincidences	Low	43	33.94	1459.50
	High	40	50.66	2026.50
	Total	83		

Test Statistics[a]

	Total_coincidences
Mann-Whitney U	513.500
Wilcoxon W	1459.500
Z	-3.166
Asymp. Sig. (2-tailed)	.002

a. Grouping Variable: PDI_Group

Chapter 6

Explore

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Poor total	113	100.0%	0	0.0%	113	100.0%
Possible total	113	100.0%	0	0.0%	113	100.0%
Good total	113	100.0%	0	0.0%	113	100.0%
Excellent total	113	100.0%	0	0.0%	113	100.0%

Descriptives

			Statistic	Std. Error
Poor total	Mean		7.6991	.43563
	95% Confidence Interval for Mean	Lower Bound	6.8360	
		Upper Bound	8.5623	
	5% Trimmed Mean		7.4626	
	Median		7.0000	
	Variance		21.444	
	Std. Deviation		4.63081	
	Minimum		.00	
	Maximum		22.00	
	Range		22.00	
	Interquartile Range		5.00	
	Skewness		.744	.227
	Kurtosis		.692	.451
Possible total	Mean		9.3097	.38992
	95% Confidence Interval for Mean	Lower Bound	8.5372	
		Upper Bound	10.0823	
	5% Trimmed Mean		9.1903	
	Median		9.0000	
	Variance		17.180	
	Std. Deviation		4.14488	
	Minimum		.00	
	Maximum		27.00	
	Range		27.00	
	Interquartile Range		4.00	
	Skewness		.702	.227
	Kurtosis		2.338	.451
Good total	Mean		7.7965	.34568
	95% Confidence Interval for Mean	Lower Bound	7.1115	
		Upper Bound	8.4814	
	5% Trimmed Mean		7.7178	
	Median		8.0000	
	Variance		13.503	
	Std. Deviation		3.67462	
	Minimum		.00	
	Maximum		20.00	
	Range		20.00	
	Interquartile Range		4.00	

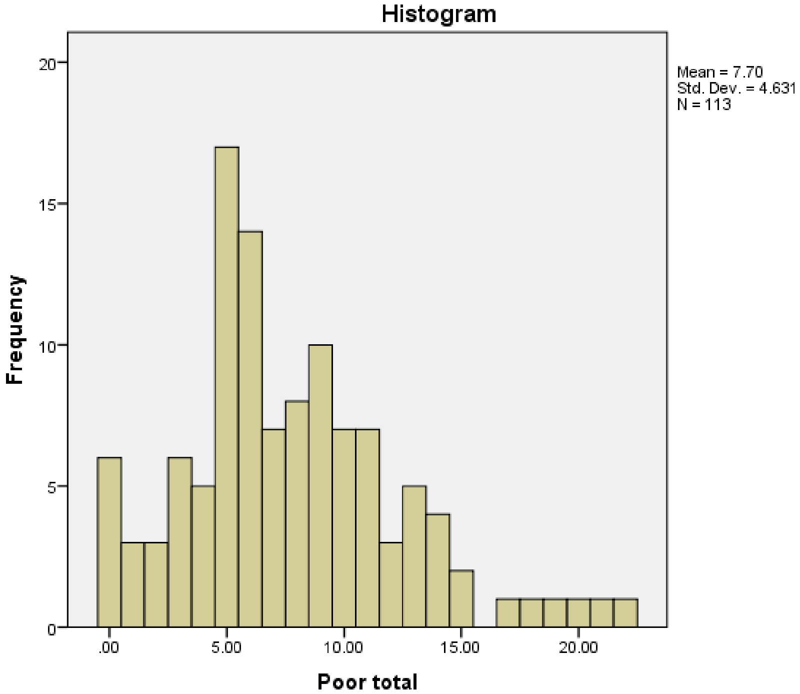
	Skewness		.420	.227
	Kurtosis		1.514	.451
Excellent total	Mean		1.4867	.19069
	95% Confidence Interval for Mean	Lower Bound	1.1089	
		Upper Bound	1.8646	
	5% Trimmed Mean		1.2561	
	Median		1.0000	
	Variance		4.109	
	Std. Deviation		2.02712	
	Minimum		.00	
	Maximum		11.00	
	Range		11.00	
	Interquartile Range		2.00	
	Skewness		1.905	.227
	Kurtosis		4.324	.451

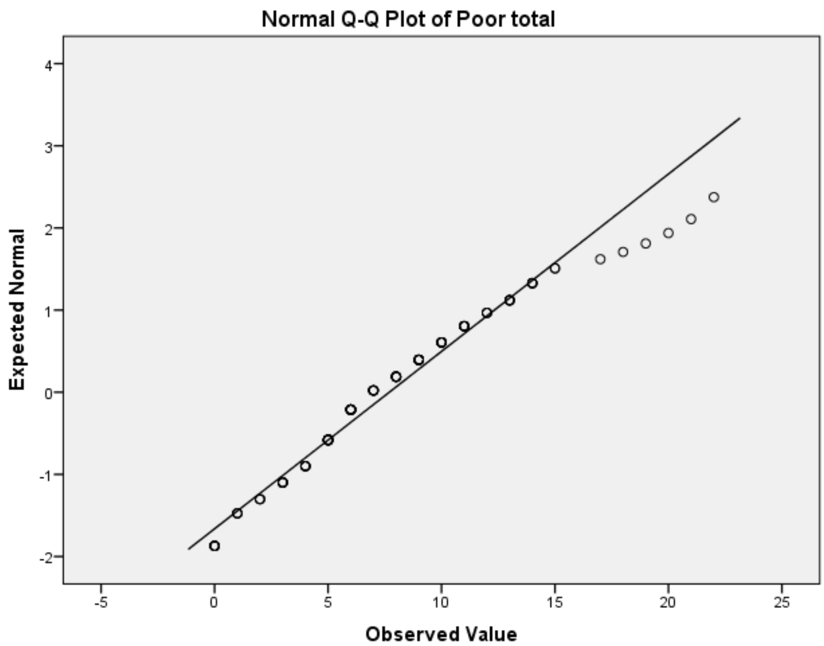
Tests of Normality

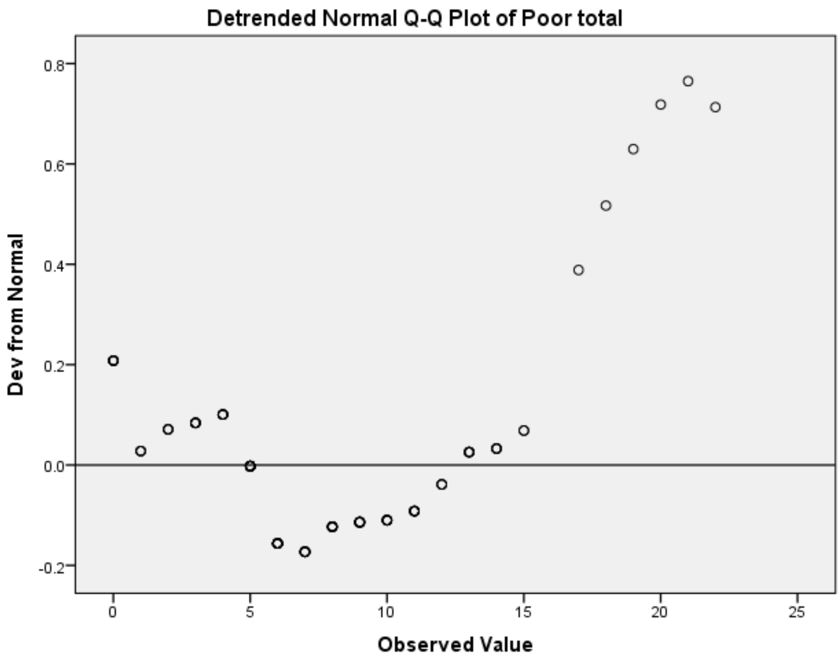
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Poor total	.121	113	.000	.955	113	.001
Possible total	.129	113	.000	.960	113	.002
Good total	.127	113	.000	.952	113	.000
Excellent total	.259	113	.000	.742	113	.000

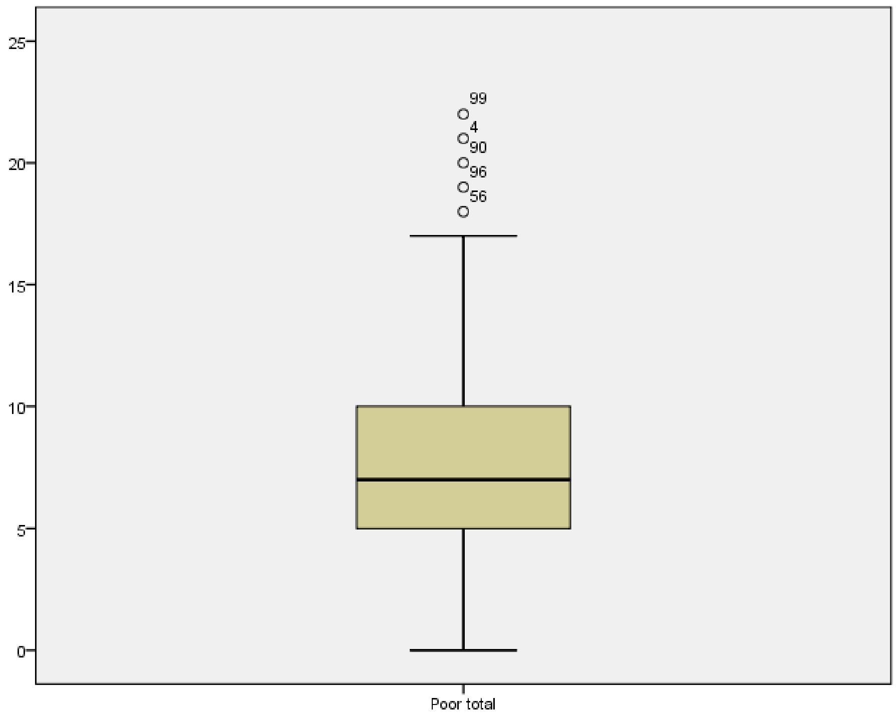
a. Lilliefors Significance Correction

Poor total

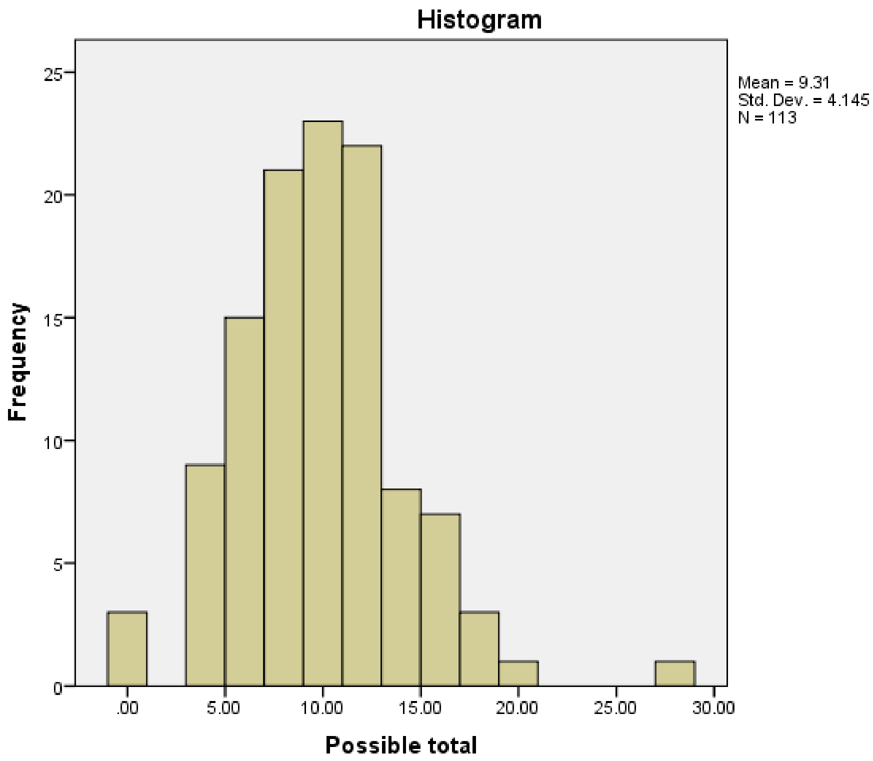

Histogram
Mean = 7.70
Std. Dev. = 4.631
N = 113
Frequency
20
15
10
5
0
.00
5.00
10.00
15.00
20.00
Poor total

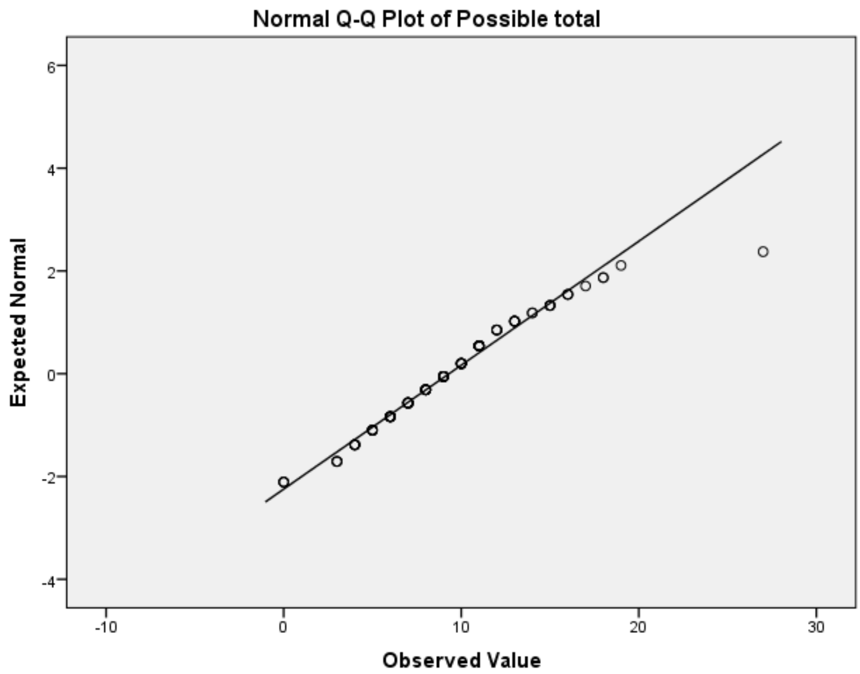

Normal Q-Q Plot of Poor total
Expected Normal
4
3
2
1
0
-1
-2
-5
0
5
10
15
20
25
Observed Value

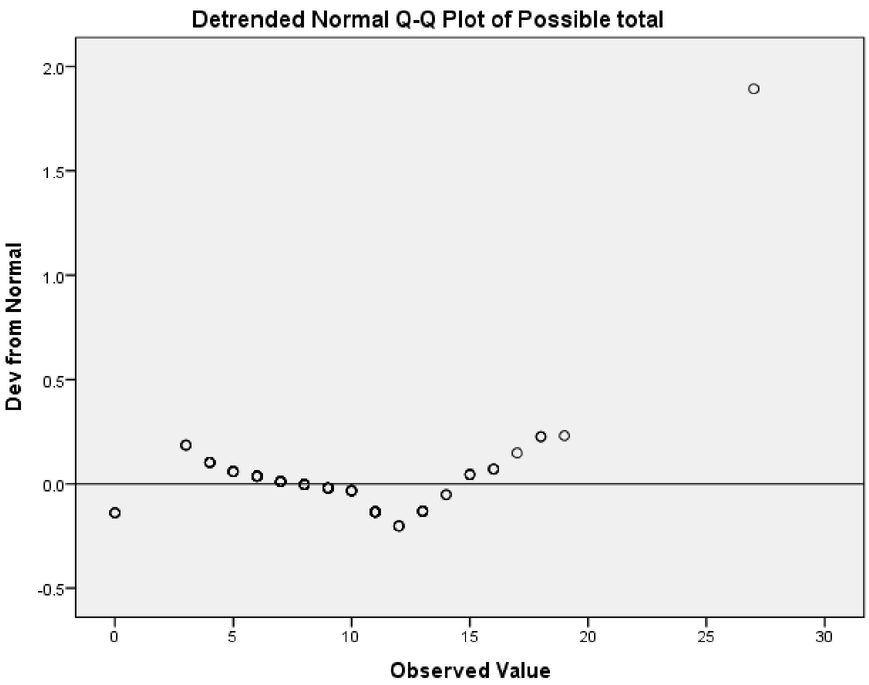

Detrended Normal Q-Q Plot of Poor total
Dev from Normal
0.8
0.6
0.4
0.2
0.0
-0.2
0
5
10
15
20
25
Observed Value

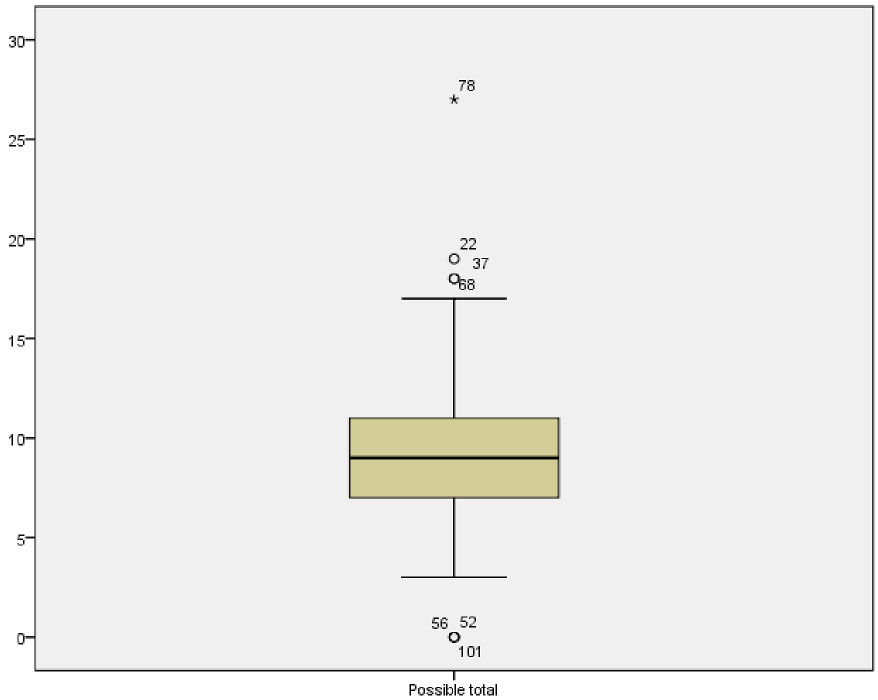

25
20
15
10
5
0
99
4
90
96
56
Poor total

Possible total

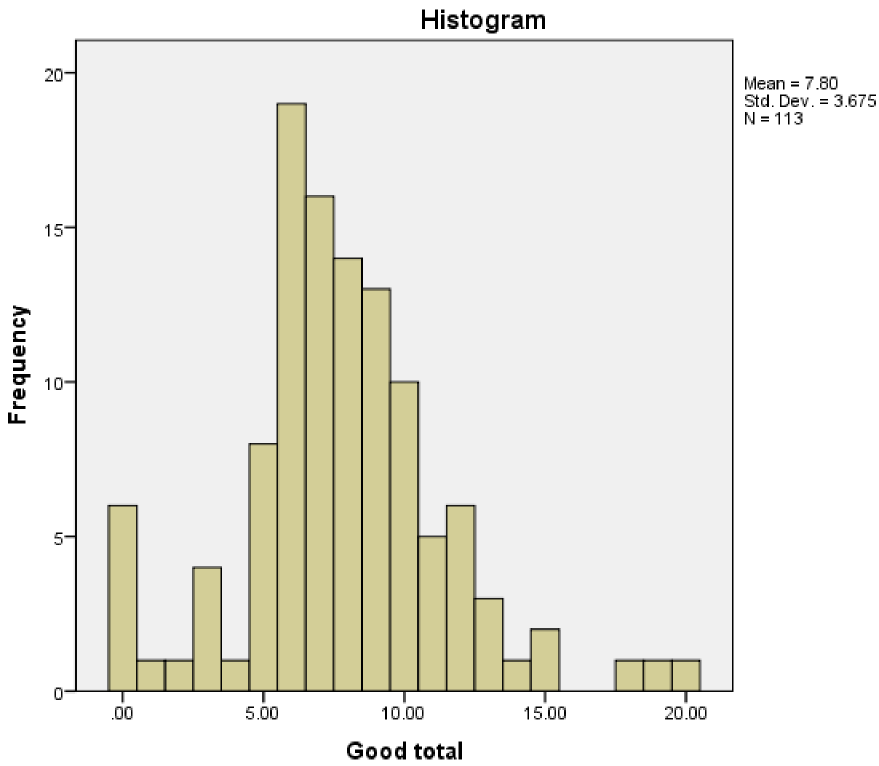




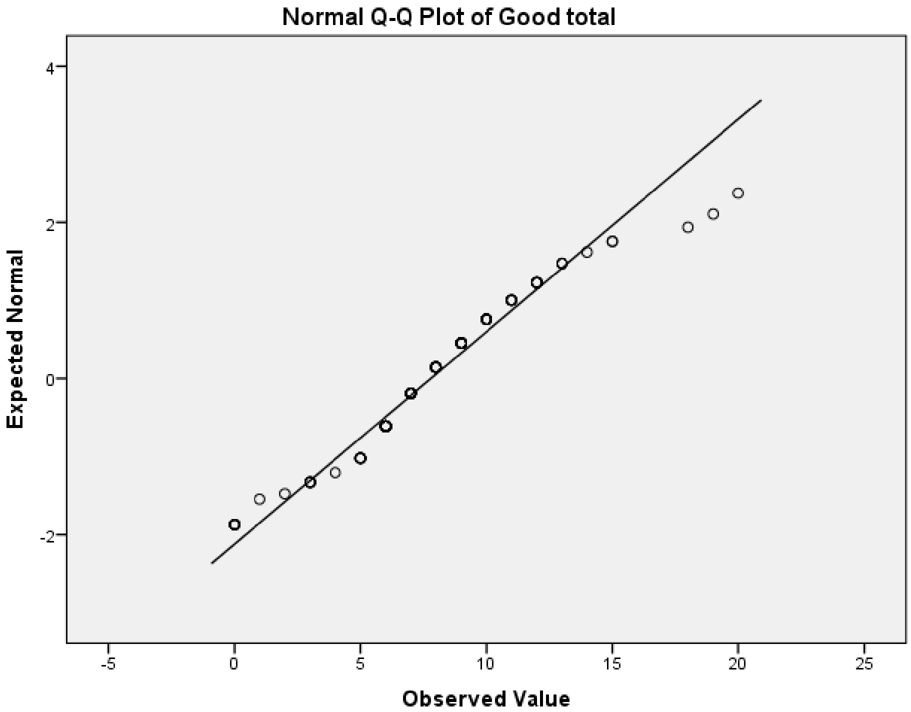

Detrended Normal Q-Q Plot of Possible total
Dev from Normal
2.0
1.5
1.0
0.5
0.0
-0.5
0
5
10
15
20
25
30
Observed Value


30
25
20
15
10
5
0
78
22
37
68
56
52
101
Possible total

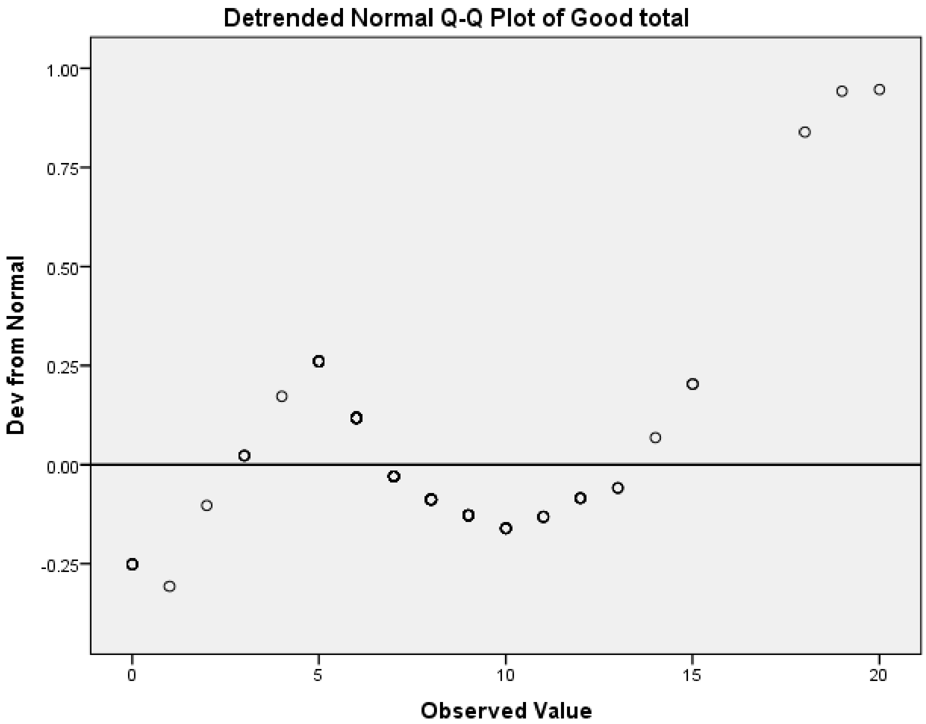
Good total

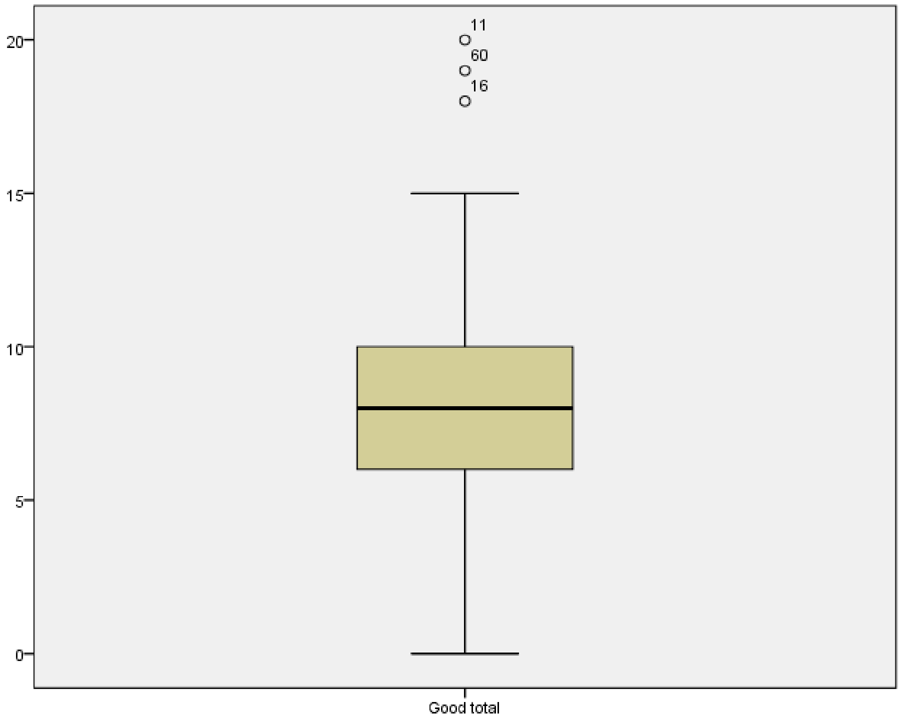


Histogram
Mean = 7.80
Std. Dev. = 3.675
N = 113
Frequency
0
5
10
15
20
.00
5.00
10.00
15.00
20.00
Good total

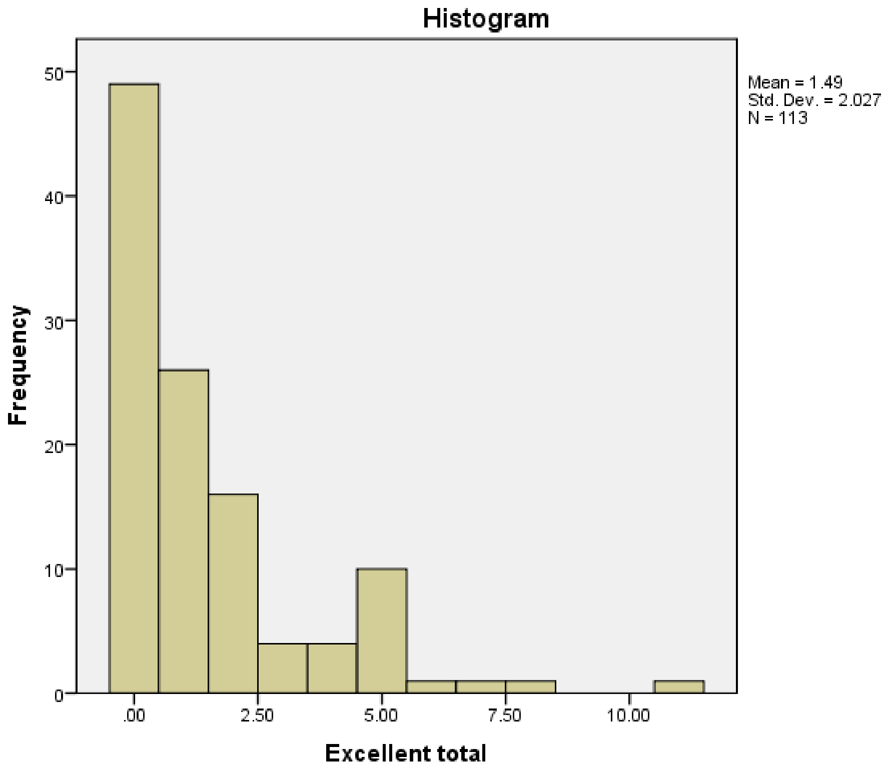


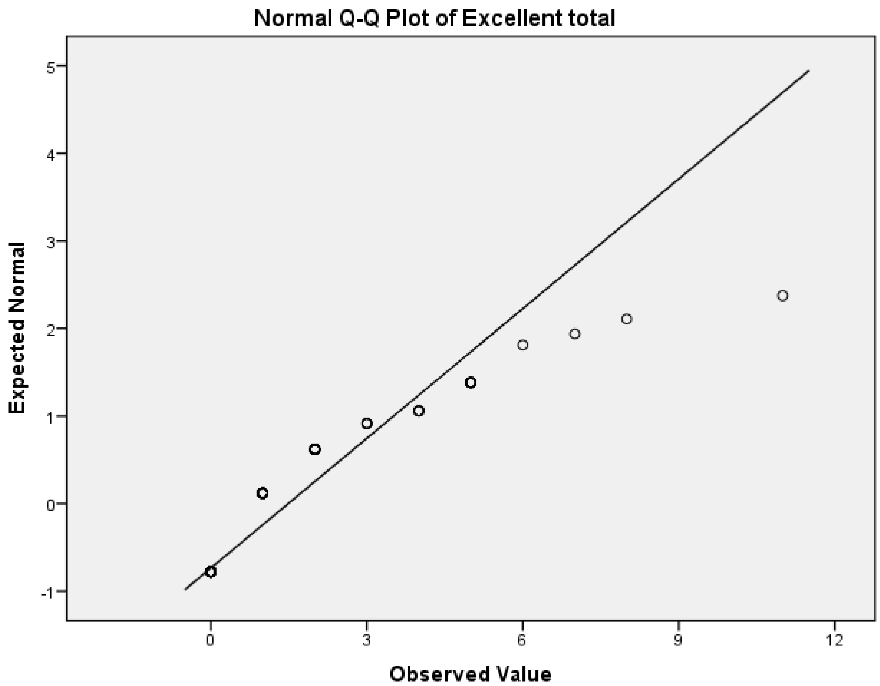
Normal Q-Q Plot of Good total
Expected Normal
4
2
0
-2
-5
0
5
10
15
20
25
Observed Value

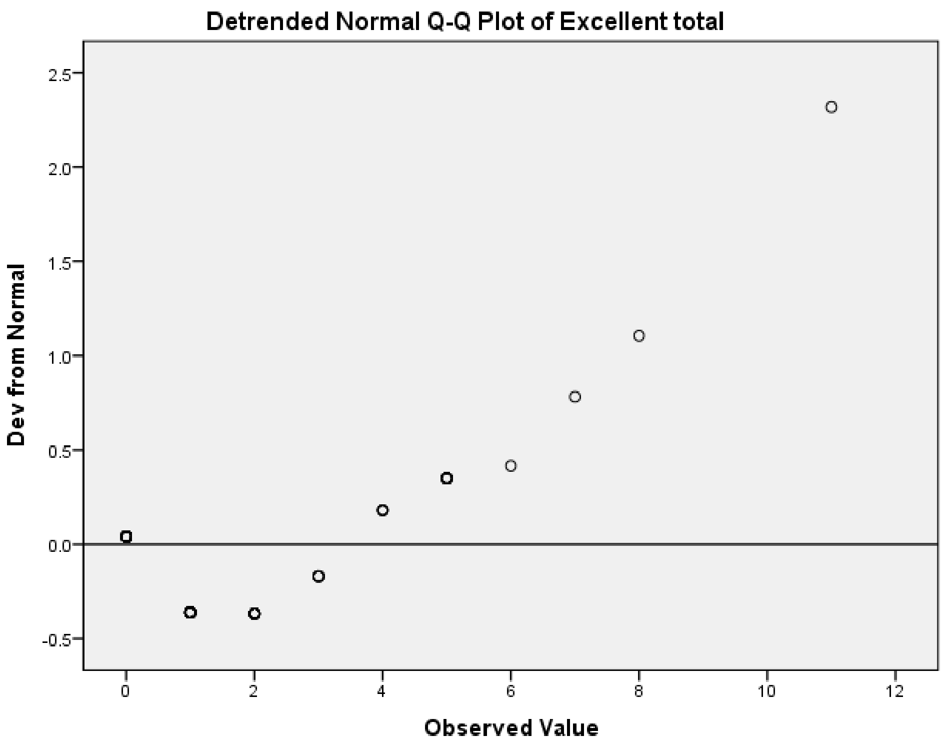

Detrended Normal Q-Q Plot of Good total
Dev from Normal
1.00
0.75
0.50
0.25
0.00
-0.25
0
5
10
15
20
Observed Value

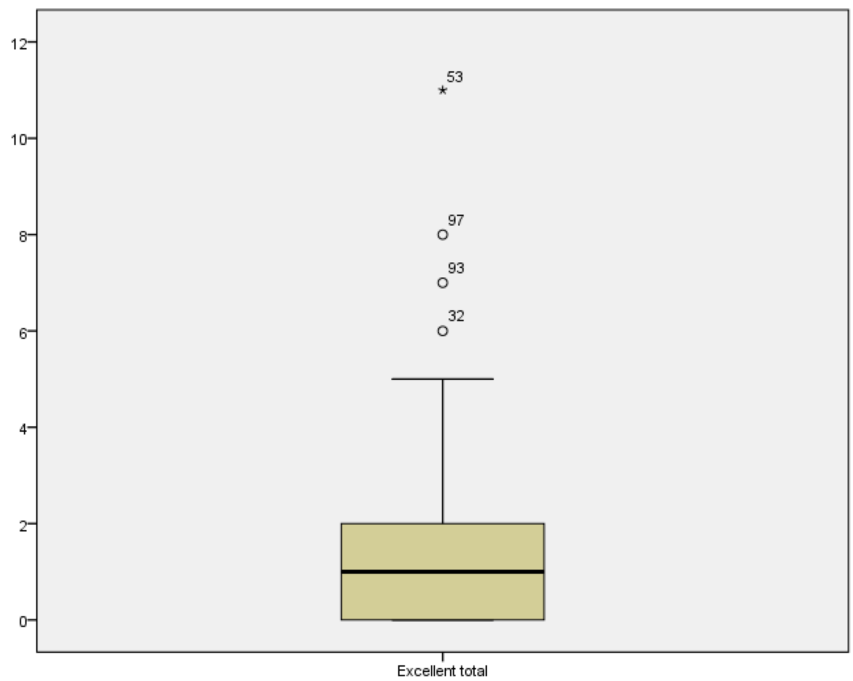

20
15
10
5
0
11
60
16
Good total

Excellent total






Detrended Normal Q-Q Plot of Excellent total
Dev from Normal
Observed Value
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
0
2
4
6
8
10
12


12
10
8
6
4
2
0
53
97
93
32
Excellent total

Thematic Apperception test with 3 interpretations

Explore

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Poor 3 interpretation	113	100.0%	0	0.0%	113	100.0%
Possible 3 interpretations	113	100.0%	0	0.0%	113	100.0%
Good 3 interpretations	113	100.0%	0	0.0%	113	100.0%
Excellent 3 interpretations	113	100.0%	0	0.0%	113	100.0%

Descriptives

			Statistic	Std. Error
Poor 3 interpretation	Mean		2.2655	.15952
	95% Confidence Interval for Mean	Lower Bound	1.9494	
		Upper Bound	2.5815	
	5% Trimmed Mean		2.1903	
	Median		2.0000	
	Variance		2.875	
	Std. Deviation		1.69568	
	Minimum		.00	
	Maximum		7.00	
	Range		7.00	
	Interquartile Range		2.00	
	Skewness		.457	.227
	Kurtosis		-.301	.451
Possible 3 interpretations	Mean		3.0265	.16170
	95% Confidence Interval for Mean	Lower Bound	2.7062	
		Upper Bound	3.3469	
	5% Trimmed Mean		2.9607	
	Median		3.0000	
	Variance		2.955	
	Std. Deviation		1.71891	
	Minimum		.00	
	Maximum		9.00	

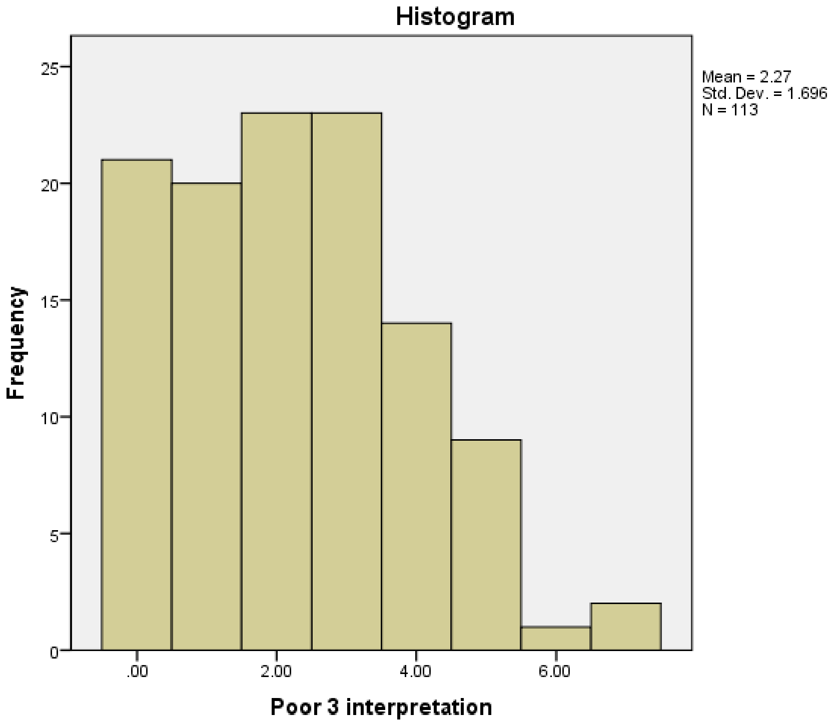
			Statistic	Std. Error
	Range		9.00	
	Interquartile Range		2.00	
	Skewness		.656	.227
	Kurtosis		.922	.451
Good 3 interpretations	Mean		2.7876	.14358
	95% Confidence Interval for Mean	Lower Bound	2.5031	
		Upper Bound	3.0721	
	5% Trimmed Mean		2.7606	
	Median		3.0000	
	Variance		2.329	
	Std. Deviation		1.52627	
	Minimum		.00	
	Maximum		7.00	
	Range		7.00	
	Interquartile Range		2.00	
	Skewness		.136	.227
	Kurtosis		-.019	.451
Excellent 3 interpretations	Mean		.7434	.10425
	95% Confidence Interval for Mean	Lower Bound	.5368	
		Upper Bound	.9499	
	5% Trimmed Mean		.6101	
	Median		.0000	
	Variance		1.228	
	Std. Deviation		1.10824	
	Minimum		.00	
	Maximum		6.00	
	Range		6.00	
	Interquartile Range		1.00	
	Skewness		1.889	.227
	Kurtosis		4.390	.451

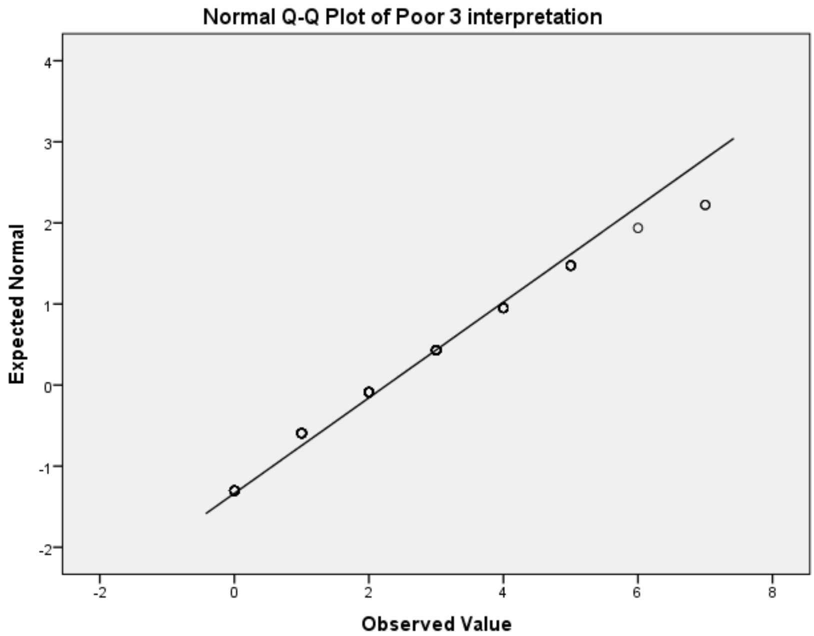
Tests of Normality

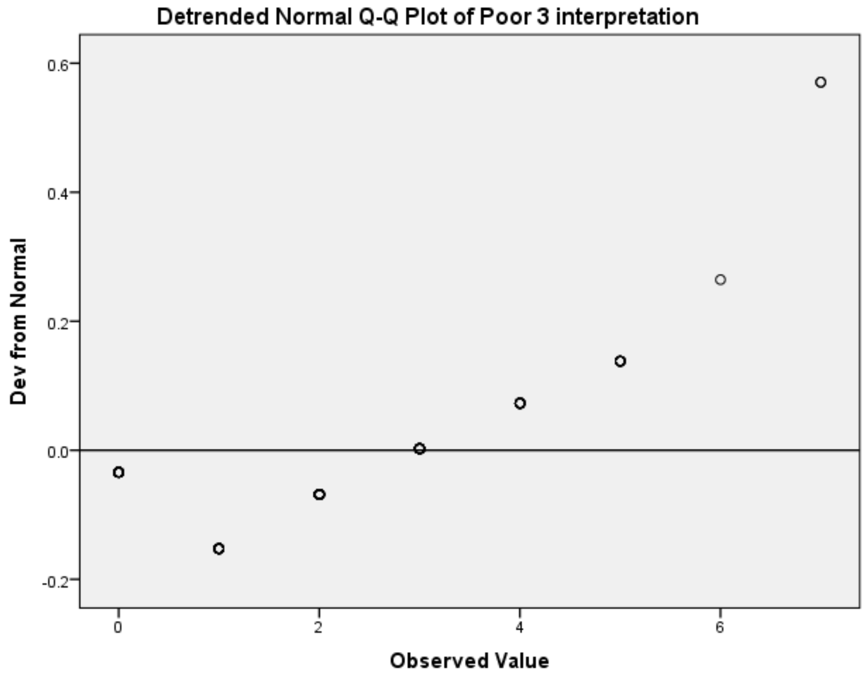
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Poor 3 interpretation	.135	113	.000	.931	113	.000
Possible 3 interpretations	.161	113	.000	.944	113	.000
Good 3 interpretations	.139	113	.000	.949	113	.000
Excellent 3 interpretations	.324	113	.000	.705	113	.000

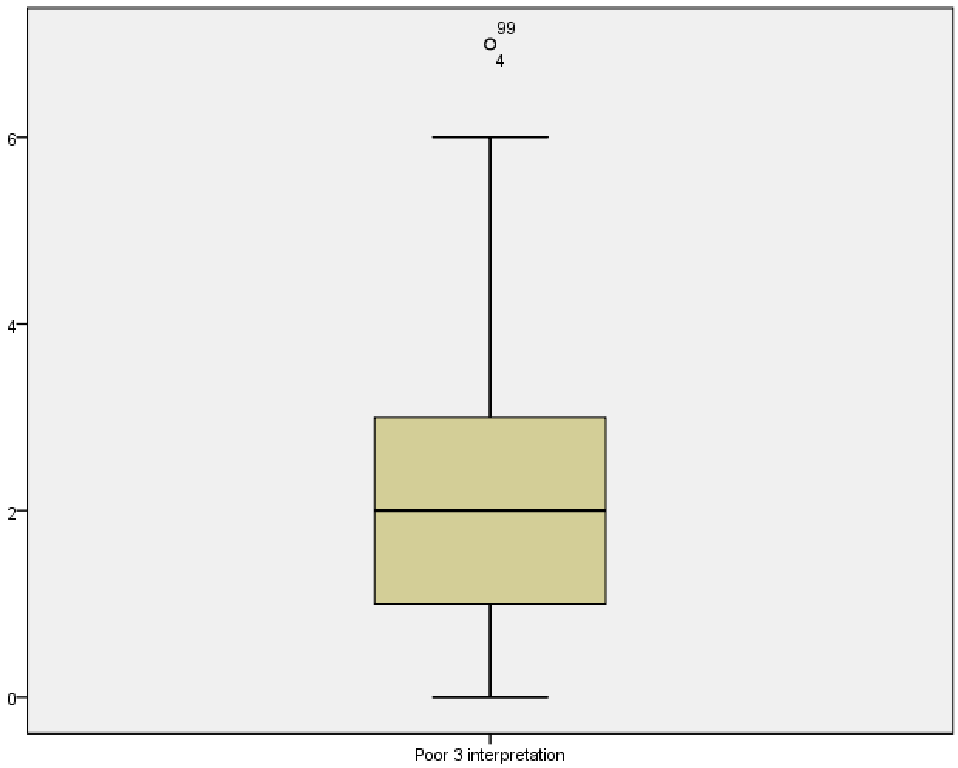
a. Lilliefors Significance Correction

Poor 3 interpretation

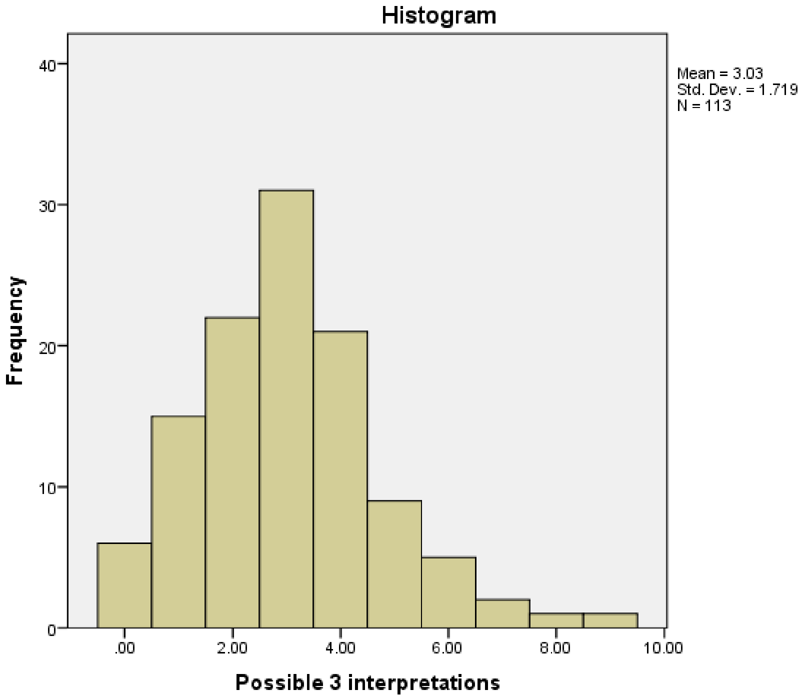


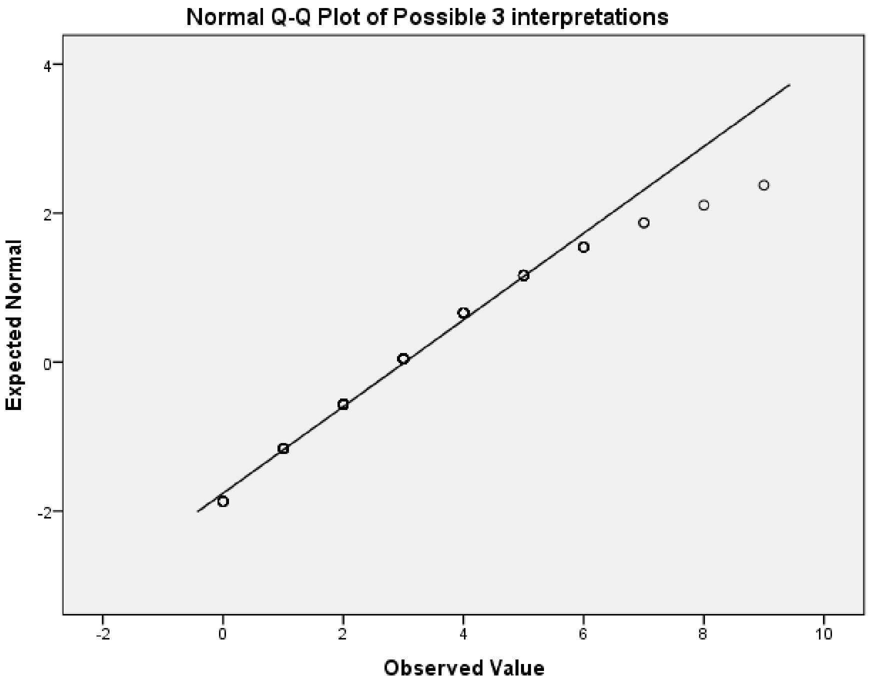


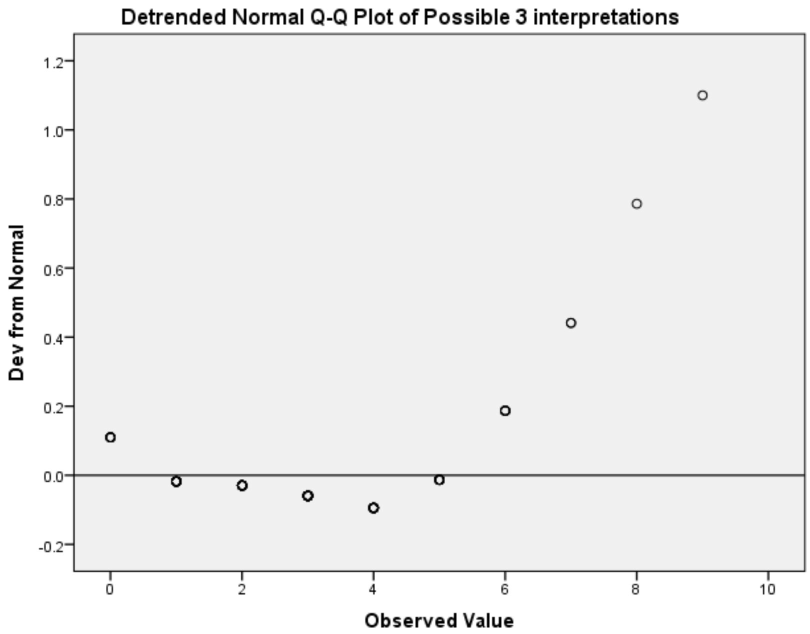

Detrended Normal Q-Q Plot of Poor 3 interpretation
0.6
0.4
0.2
0.0
-0.2
Dev from Normal
0
2
4
6
Observed Value

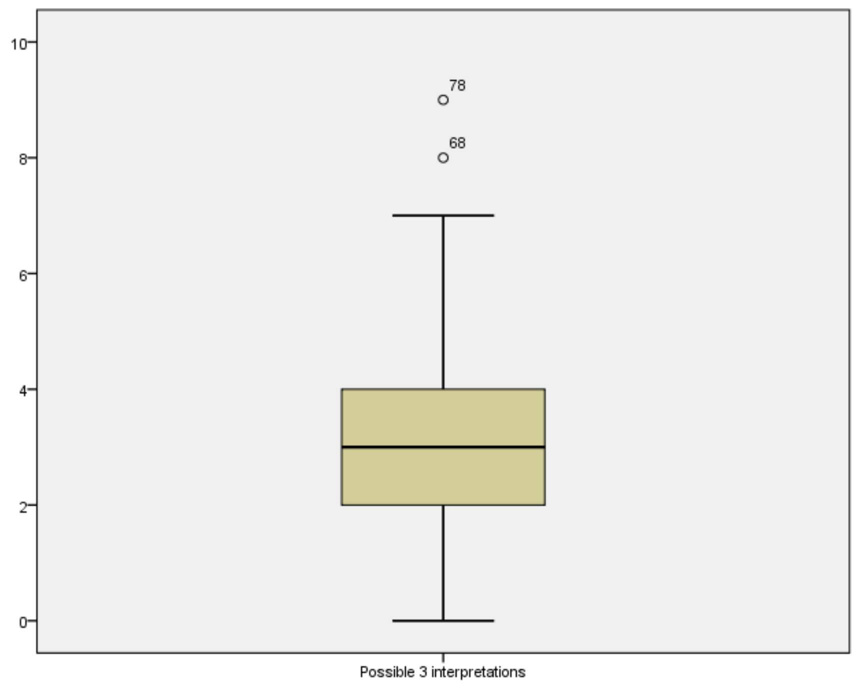

99
4
6
4
2
0
Poor 3 interpretation

Possible 3 interpretations

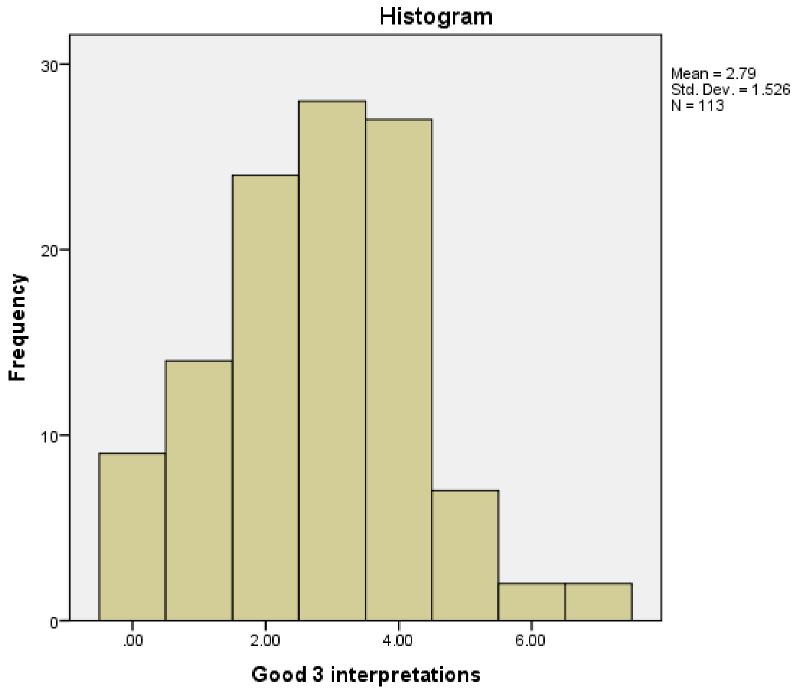


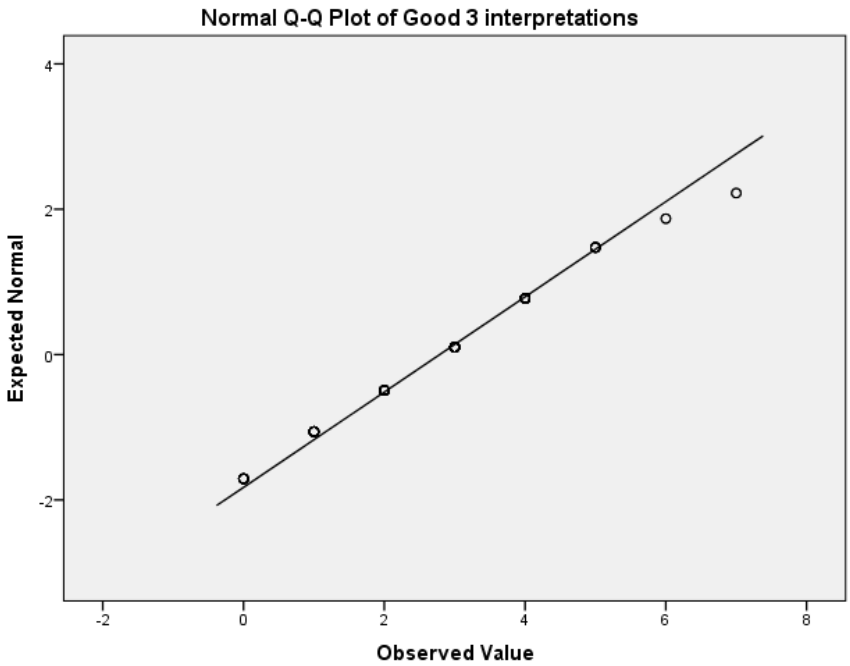


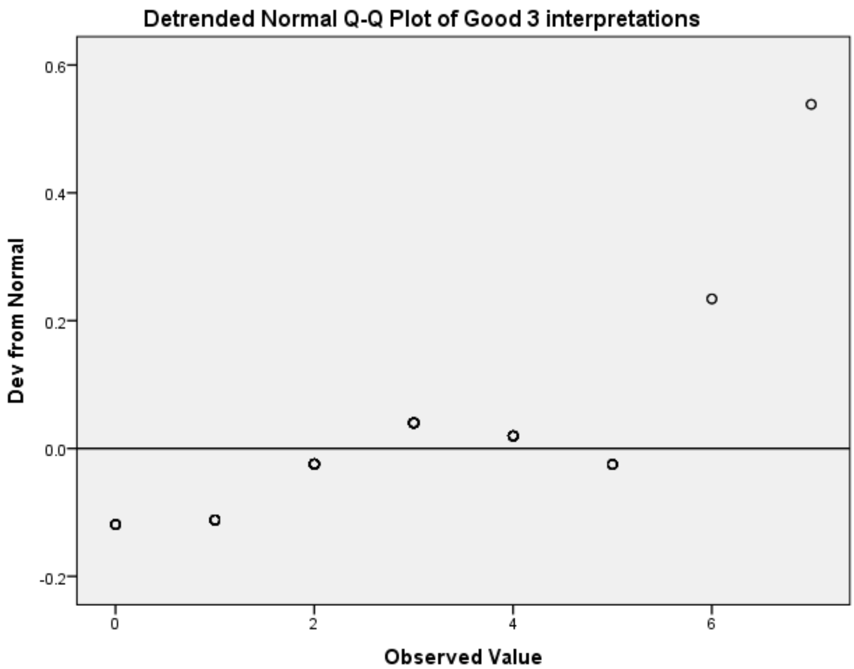

Detrended Normal Q-Q Plot of Possible 3 interpretations
Dev from Normal
Observed Value
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
0
2
4
6
8
10

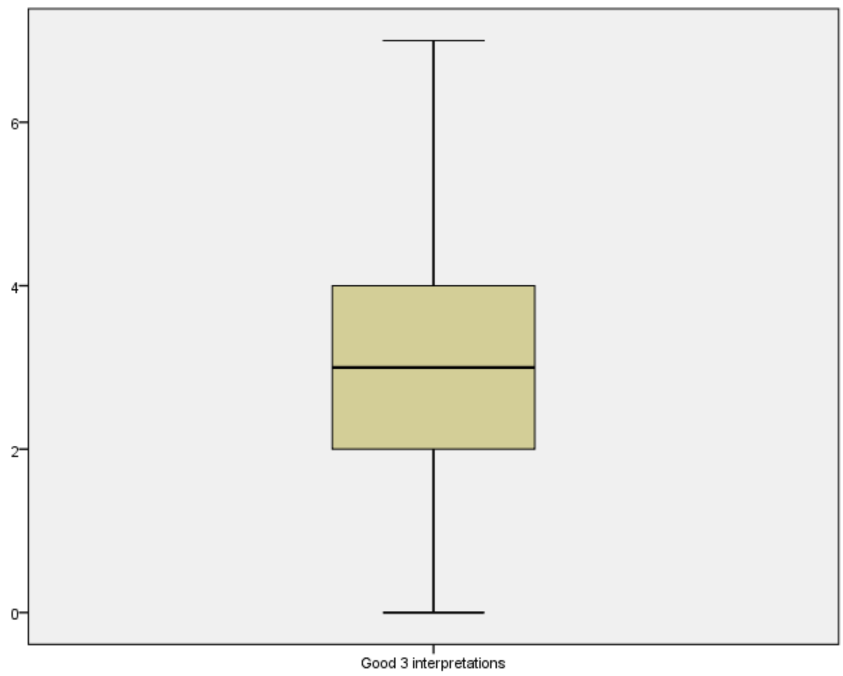

10
8
6
4
2
0
78
68
Possible 3 interpretations

Good 3 interpretations

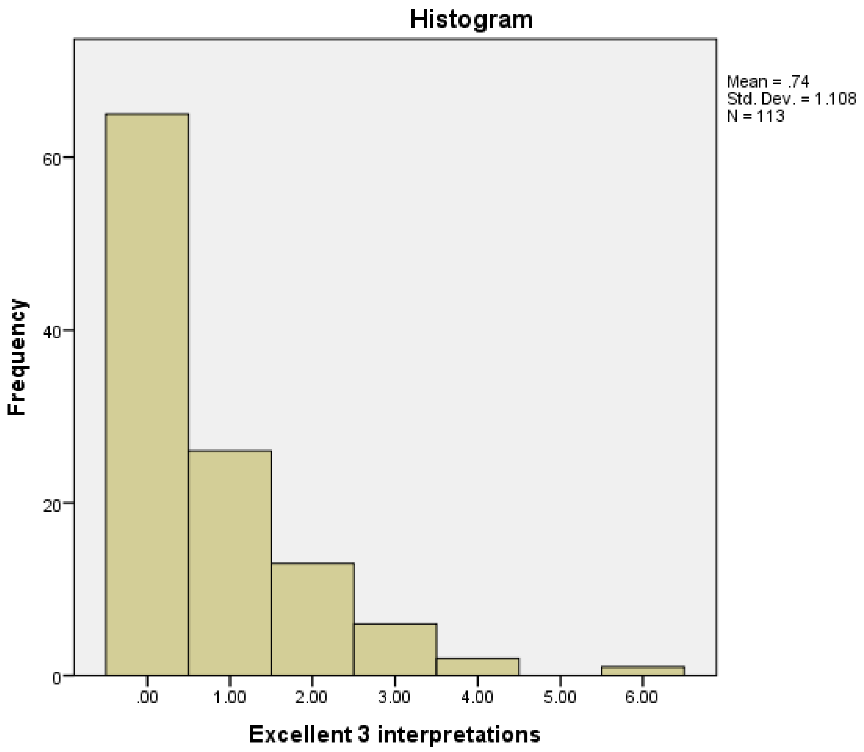


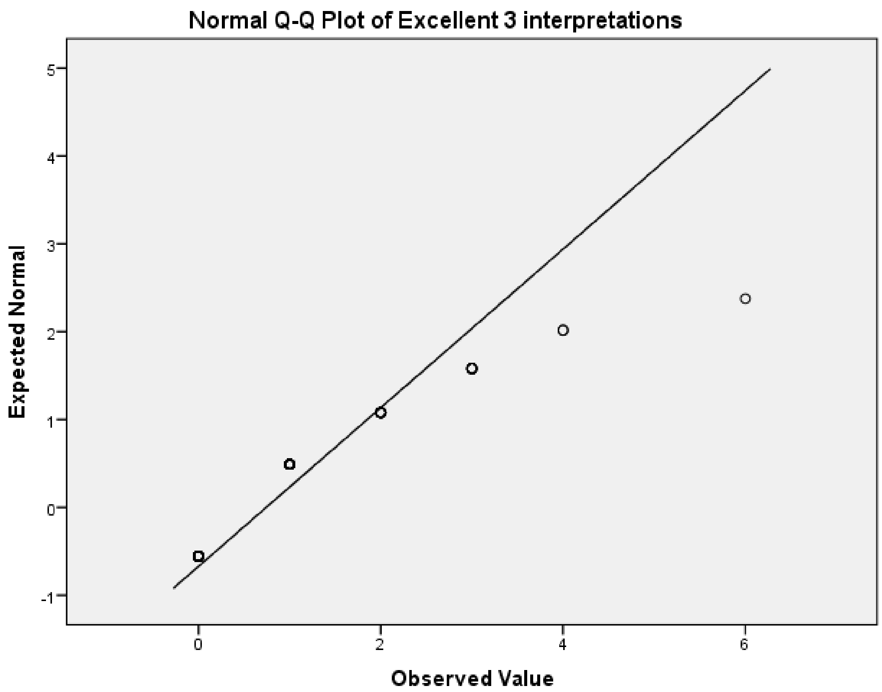


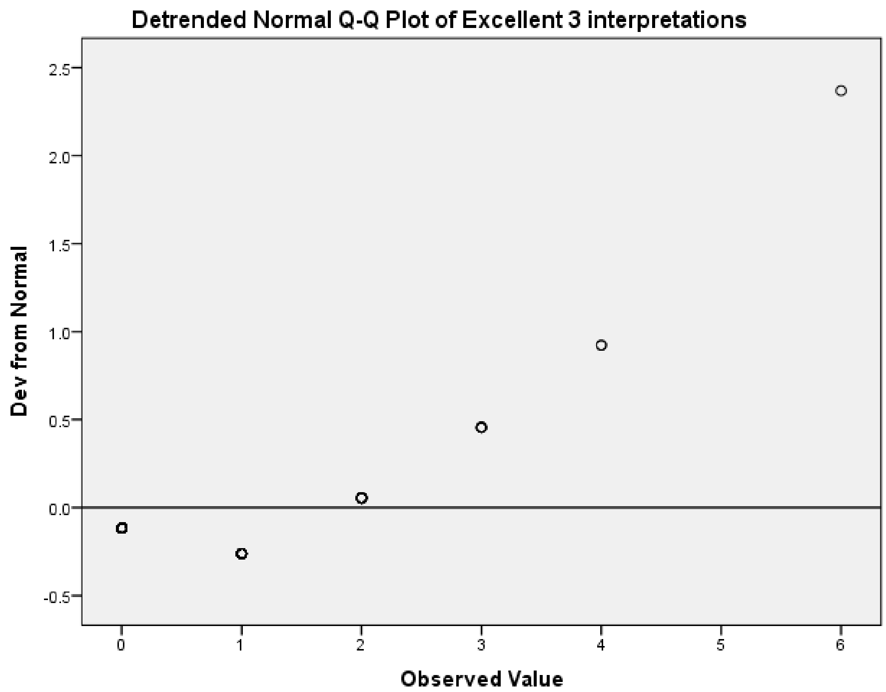

Detrended Normal Q-Q Plot of Good 3 interpretations
Dev from Normal
0.6
0.4
0.2
0.0
-0.2
0
2
4
6
Observed Value

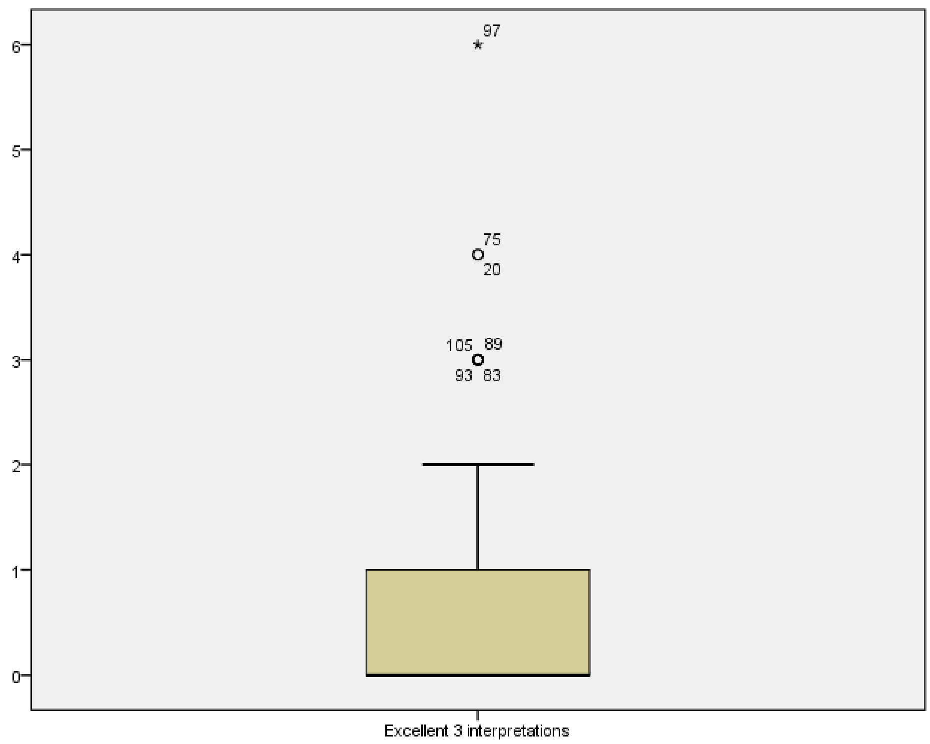

6
4
2
0
Good 3 interpretations

Excellent 3 interpretations






Detrended Normal Q-Q Plot of Excellent 3 interpretations
Dev from Normal
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
0
1
2
3
4
5
6
Observed Value


97
75
20
105
89
93
83
6
5
4
3
2
1
0
Excellent 3 interpretations

<u>**Thematic Apperception Test with 6 interpretations**</u>

Explore

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Poor 6 interpretations	113	100.0%	0	0.0%	113	100.0%
Possible 6 interpretations	113	100.0%	0	0.0%	113	100.0%
Good 6 interpretations	113	100.0%	0	0.0%	113	100.0%
Excellent 6 interpretations	113	100.0%	0	0.0%	113	100.0%

Descriptives

			Statistic	Std. Error
Poor 6 interpretations	Mean		5.4336	.31374
	95% Confidence Interval for Mean	Lower Bound	4.8120	
		Upper Bound	6.0553	
	5% Trimmed Mean		5.2625	
	Median		5.0000	
	Variance		11.123	
	Std. Deviation		3.33508	
	Minimum		.00	
	Maximum		15.00	
	Range		15.00	
	Interquartile Range		4.00	
	Skewness		.758	.227
	Kurtosis		.562	.451
Possible 6 interpretations	Mean		6.2832	.28346
	95% Confidence Interval for Mean	Lower Bound	5.7215	
		Upper Bound	6.8448	
	5% Trimmed Mean		6.1804	
	Median		6.0000	
	Variance		9.080	
	Std. Deviation		3.01327	
	Minimum		.00	
	Maximum		18.00	

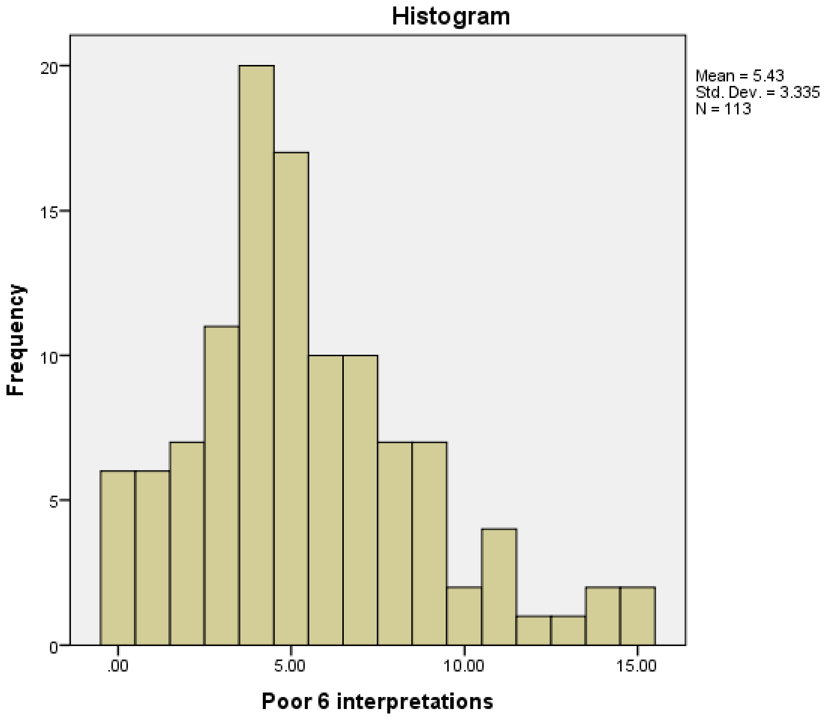
	Range		18.00	
	Interquartile Range		4.00	
	Skewness		.715	.227
	Kurtosis		1.859	.451
Good 6 interpretations	Mean		5.0088	.26294
	95% Confidence Interval for Mean	Lower Bound	4.4879	
		Upper Bound	5.5298	
	5% Trimmed Mean		4.8953	
	Median		5.0000	
	Variance		7.812	
	Std. Deviation		2.79507	
	Minimum		.00	
	Maximum		13.00	
	Range		13.00	
	Interquartile Range		3.00	
	Skewness		.553	.227
	Kurtosis		.663	.451
Excellent 6 interpretations	Mean		.7434	.11437
	95% Confidence Interval for Mean	Lower Bound	.5167	
		Upper Bound	.9700	
	5% Trimmed Mean		.5905	
	Median		.0000	
	Variance		1.478	
	Std. Deviation		1.21581	
	Minimum		.00	
	Maximum		8.00	
	Range		8.00	
	Interquartile Range		1.00	
	Skewness		2.662	.227
	Kurtosis		10.832	.451

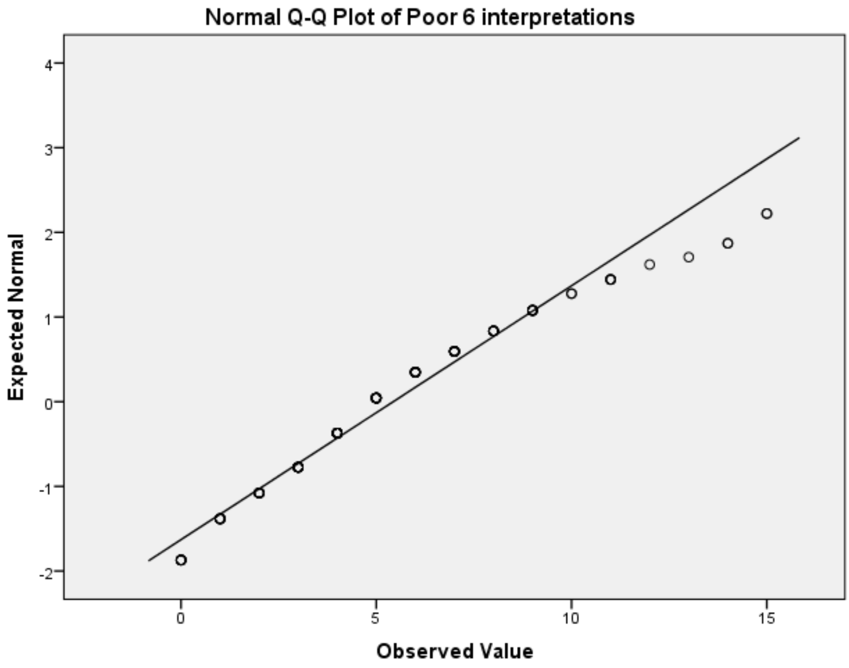
Tests of Normality

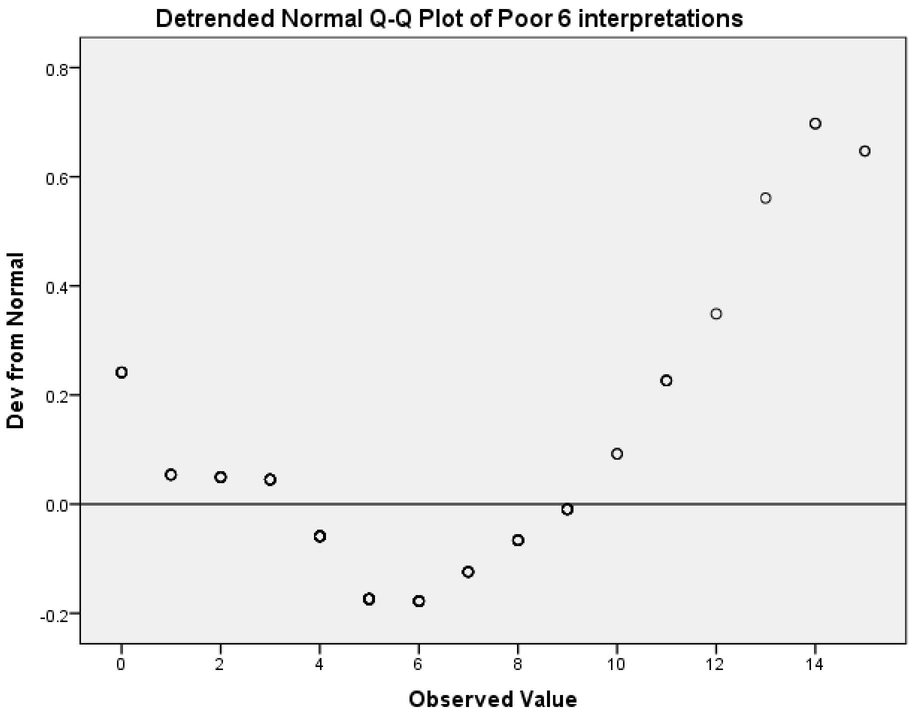
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Poor 6 interpretations	.145	113	.000	.948	113	.000
Possible 6 interpretations	.096	113	.012	.959	113	.002
Good 6 interpretations	.140	113	.000	.955	113	.001
Excellent 6 interpretations	.322	113	.000	.650	113	.000

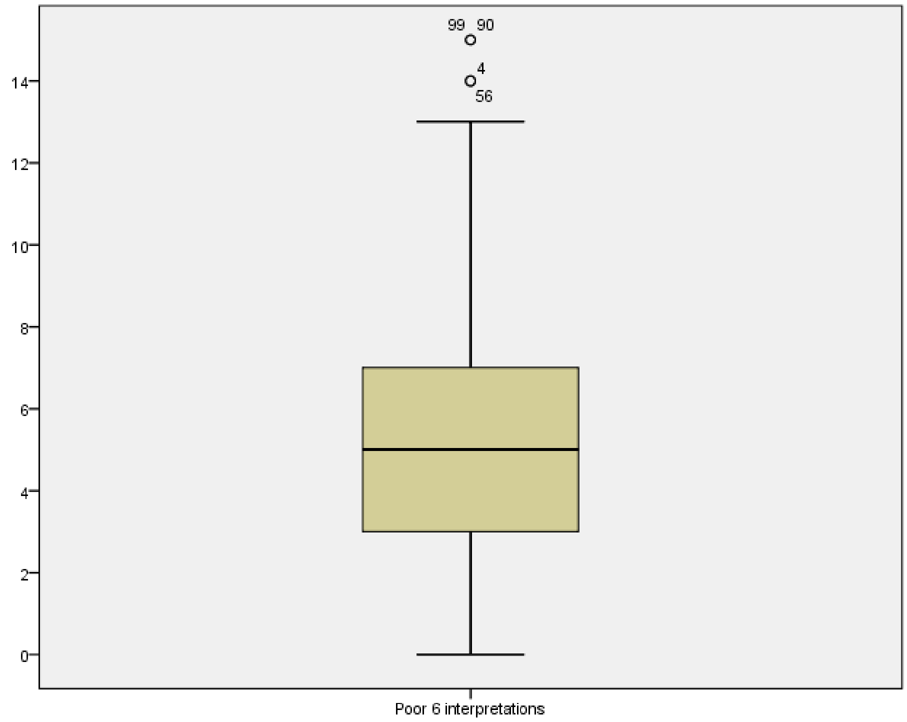
a. Lilliefors Significance Correction

Poor 6 interpretations

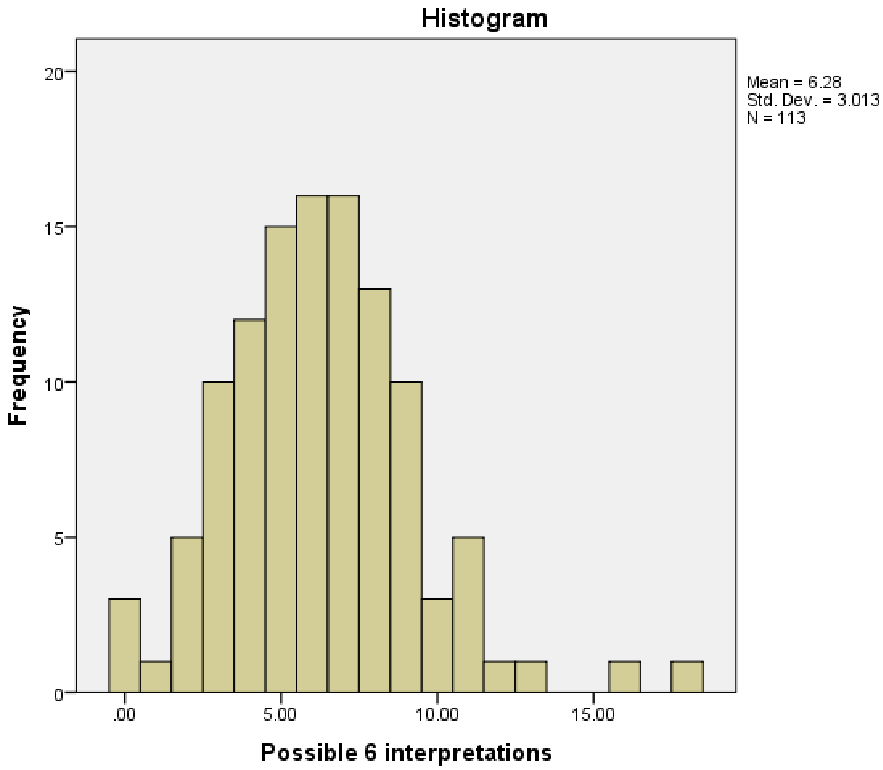


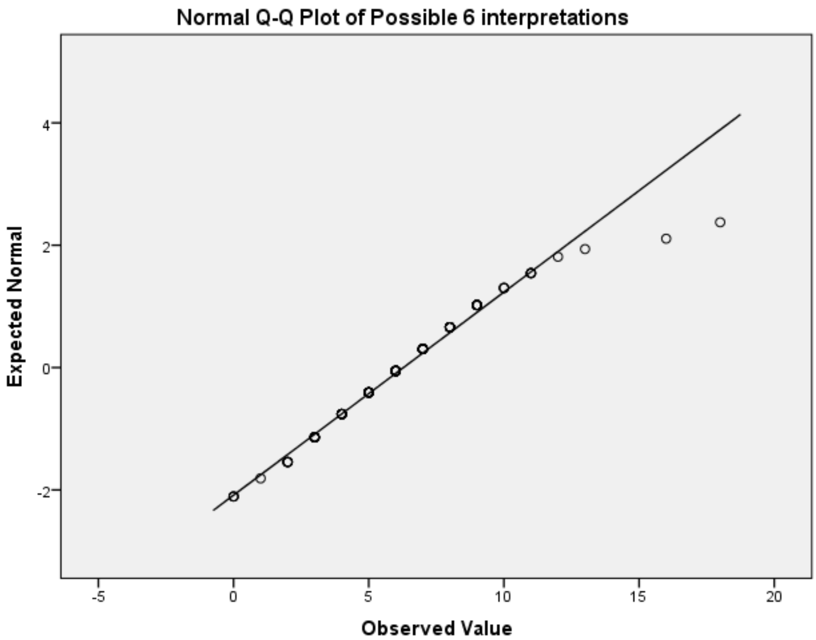


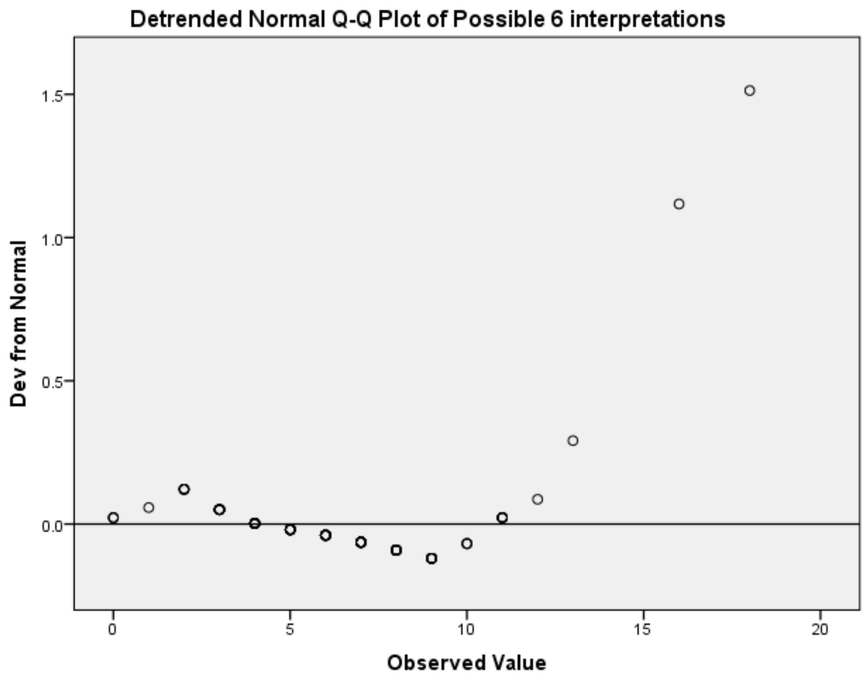

Detrended Normal Q-Q Plot of Poor 6 interpretations
Dev from Normal
Observed Value
0.8
0.6
0.4
0.2
0.0
-0.2
0
2
4
6
8
10
12
14

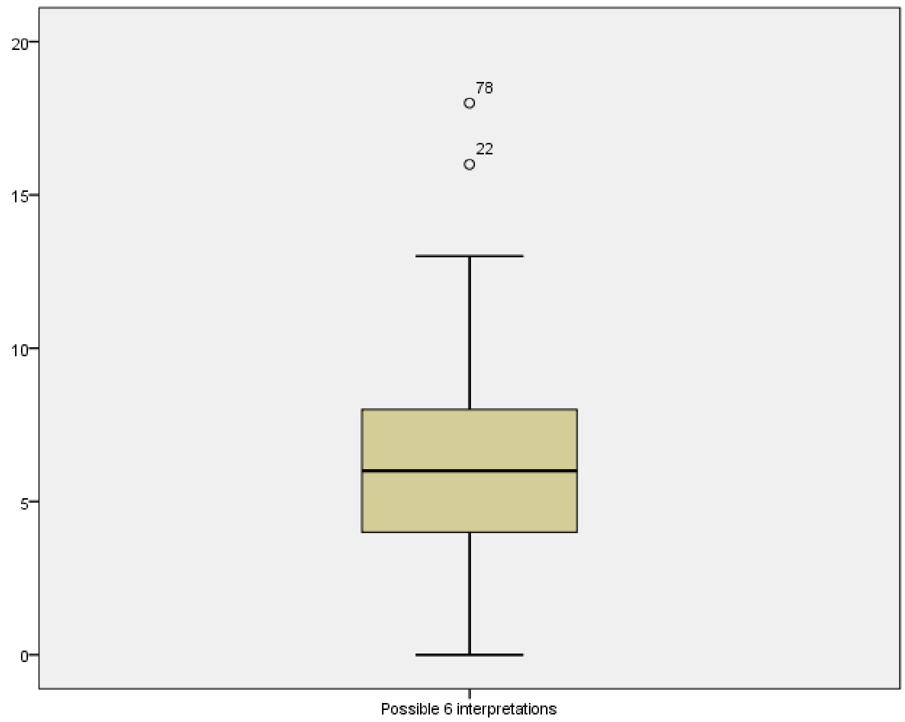

99 90
4
56
14
12
10
8
6
4
2
0
Poor 6 interpretations

Possible 6 interpretations

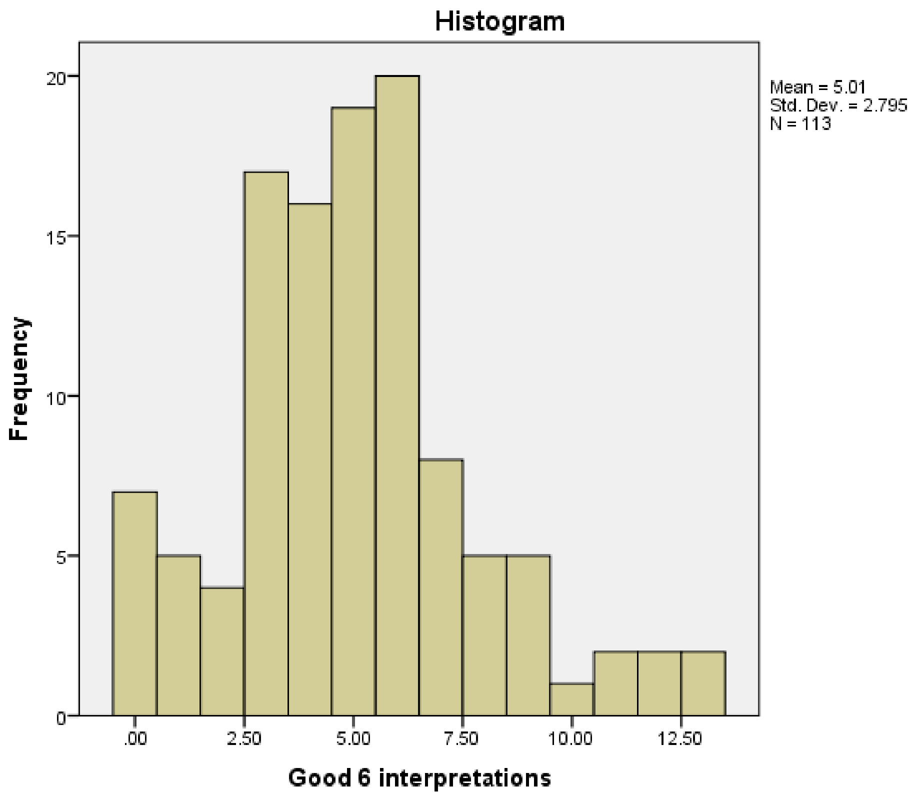


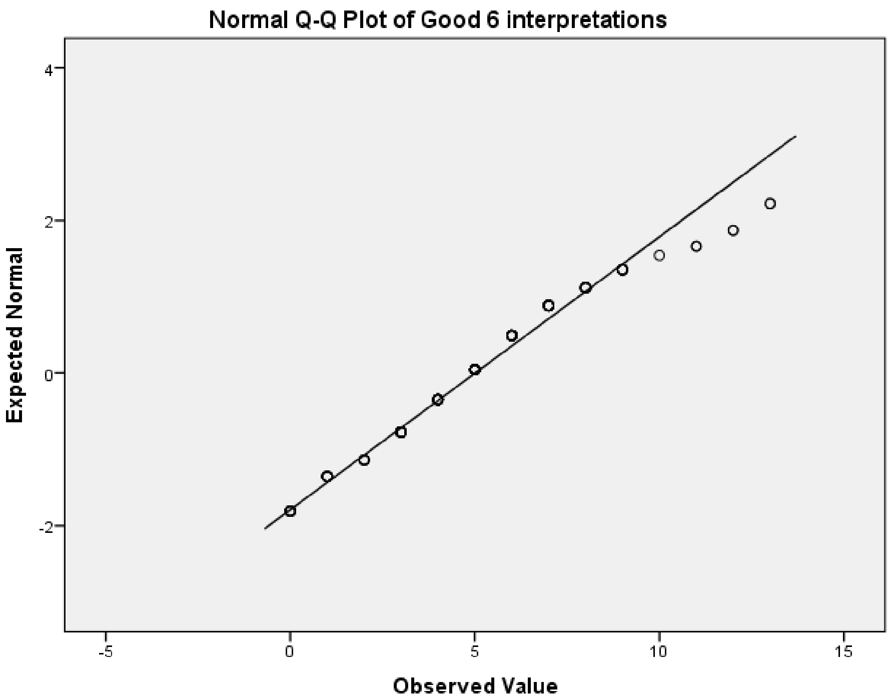


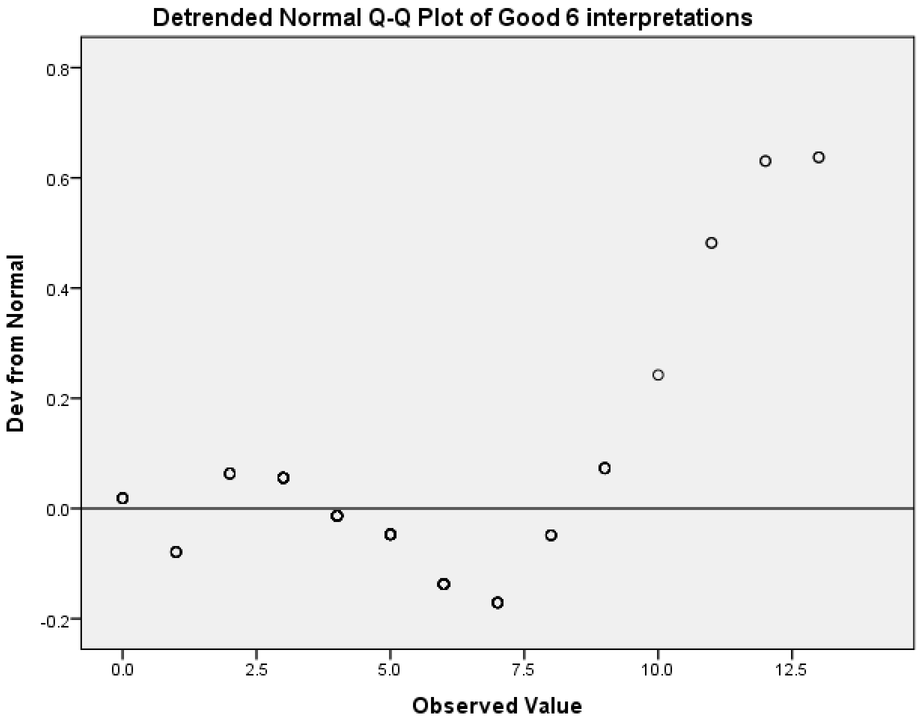

Detrended Normal Q-Q Plot of Possible 6 interpretations
Dev from Normal
1.5
1.0
0.5
0.0
0
5
10
15
20
Observed Value


20
15
10
5
0
78
22
Possible 6 interpretations

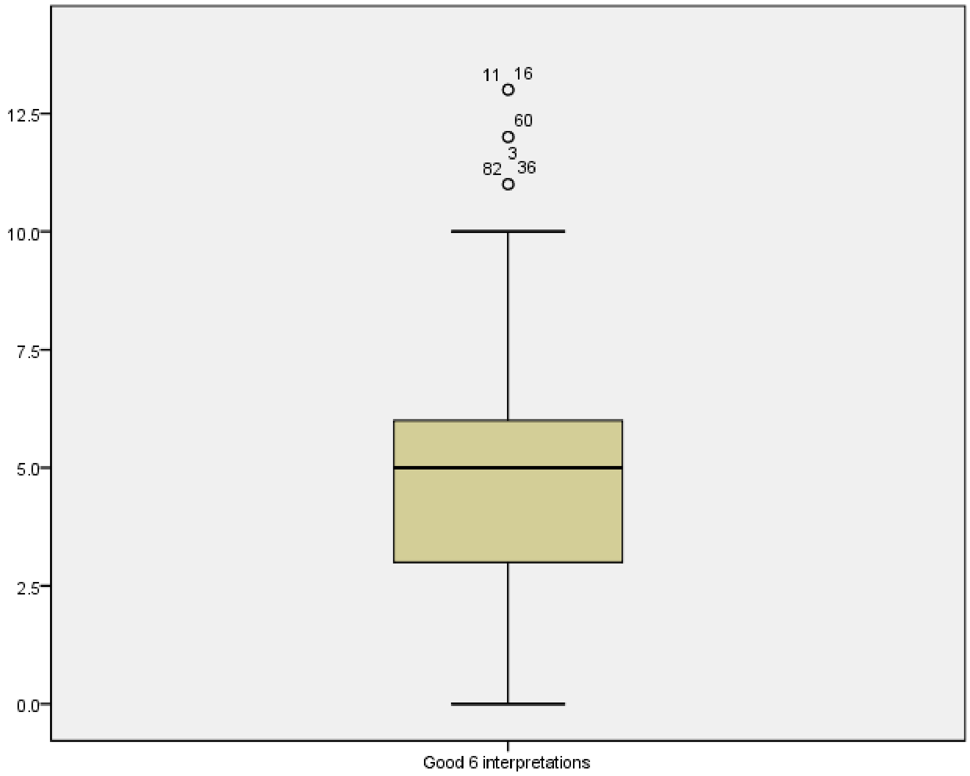
Good 6 interpretations





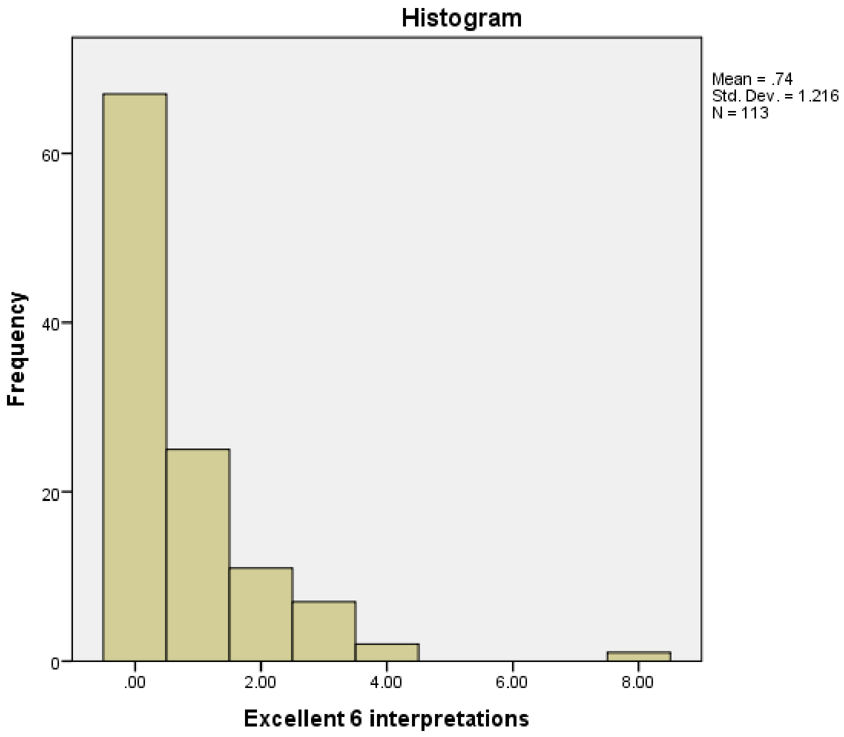


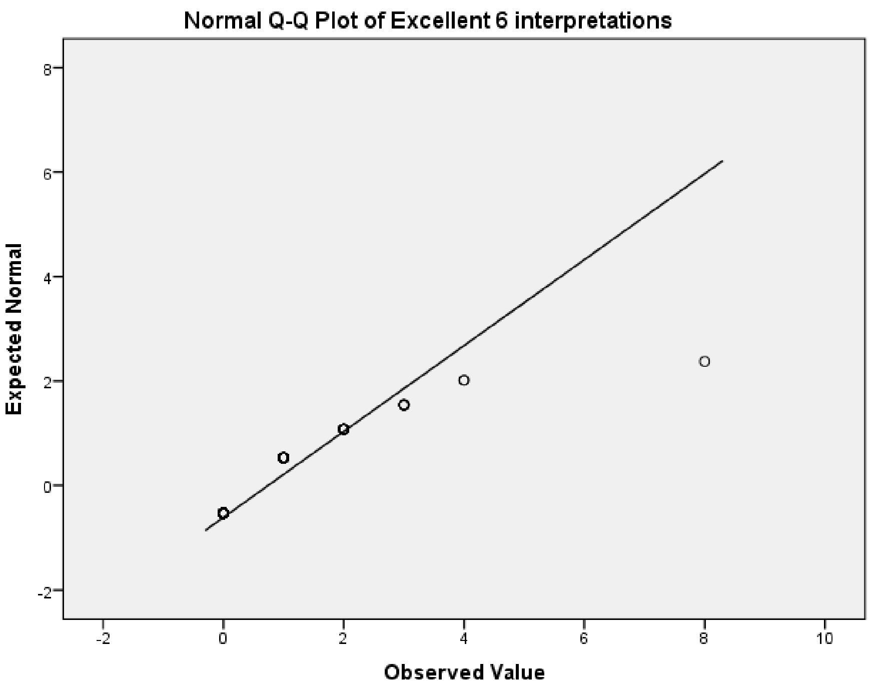
Detrended Normal Q-Q Plot of Good 6 interpretations
Dev from Normal
0.8
0.6
0.4
0.2
0.0
-0.2
0.0
2.5
5.0
7.5
10.0
12.5
Observed Value

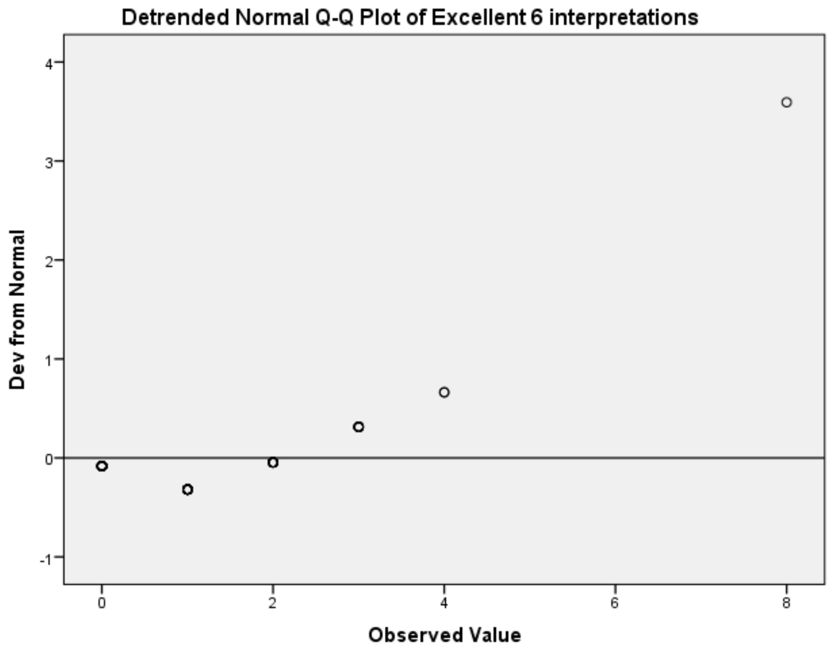


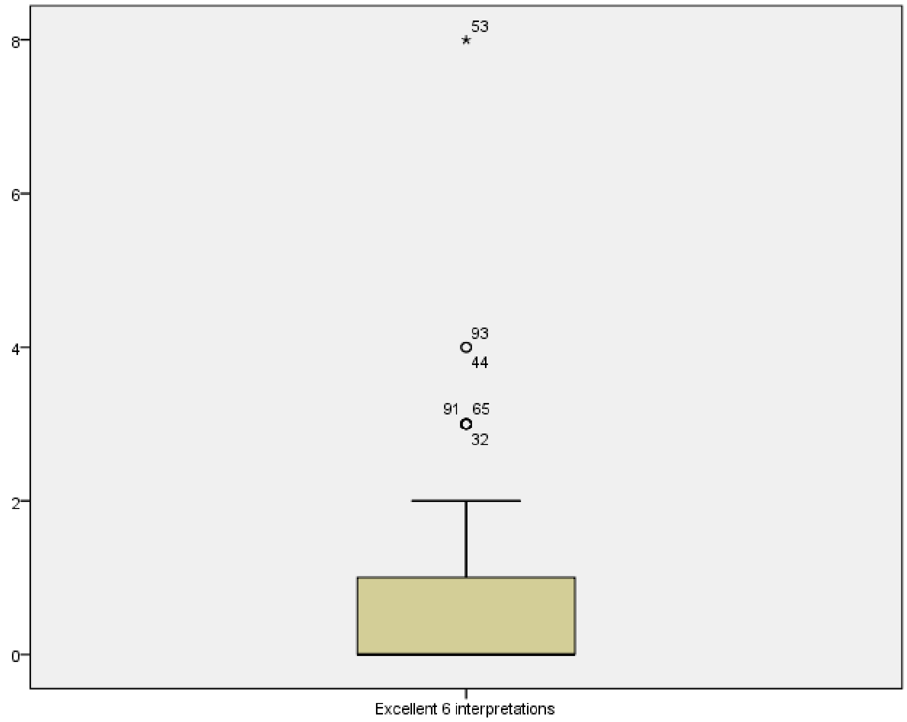
11
16
60
3
82
36
12.5
10.0
7.5
5.0
2.5
0.0
Good 6 interpretations

Excellent 6 interpretations






Detrended Normal Q-Q Plot of Excellent 6 interpretations
Dev from Normal
Observed Value


53
93
44
91
65
32
Excellent 6 interpretations

Coincidences

Explore

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Total_coincidences	113	100.0%	0	0.0%	113	100.0%

Descriptives

			Statistic	Std. Error
Total_coincidences	Mean		20.2212	.50043
	95% Confidence Interval for Mean	Lower Bound	19.2297	
		Upper Bound	21.2128	
	5% Trimmed Mean		20.1509	
	Median		20.0000	
	Variance		28.299	
	Std. Deviation		5.31966	
	Minimum		8.00	
	Maximum		34.00	
	Range		26.00	
	Interquartile Range		7.00	
	Skewness		.184	.227
	Kurtosis		-.038	.451

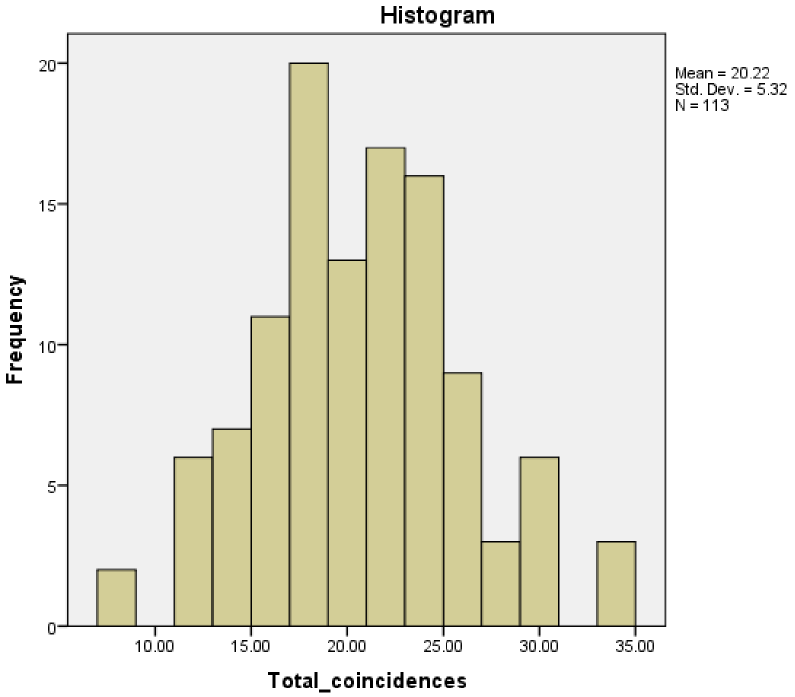
Tests of Normality

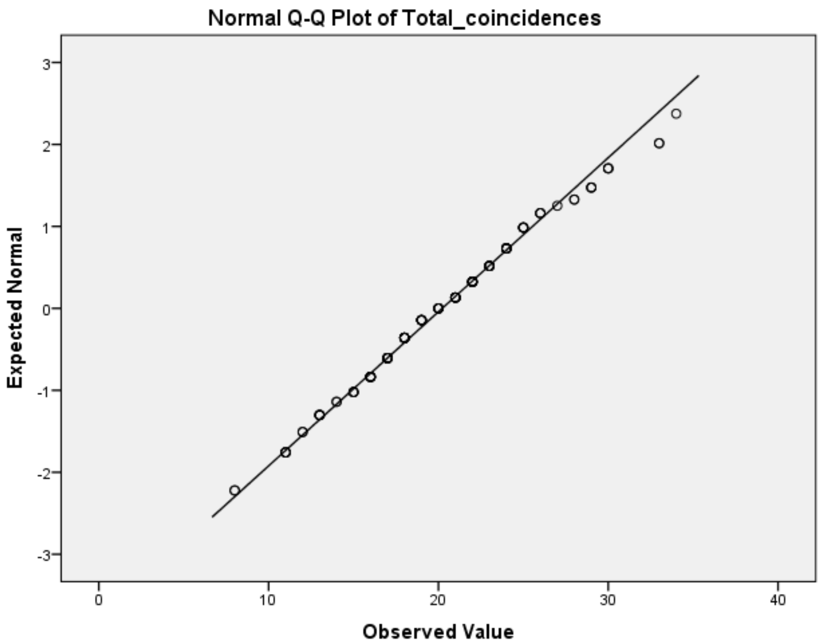
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Total_coincidences	.069	113	.200*	.989	113	.459

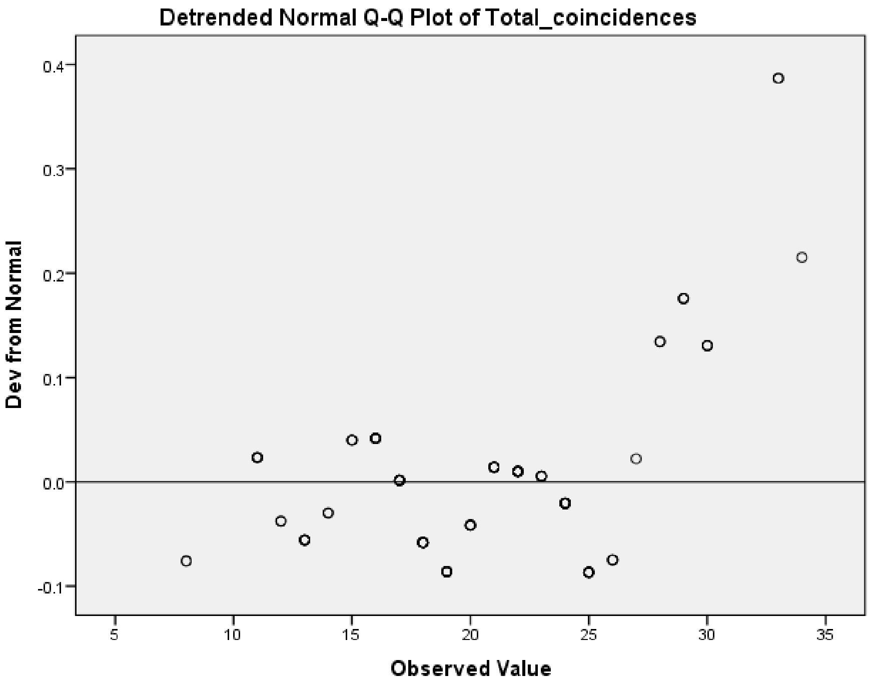
*. This is a lower bound of the true significance.

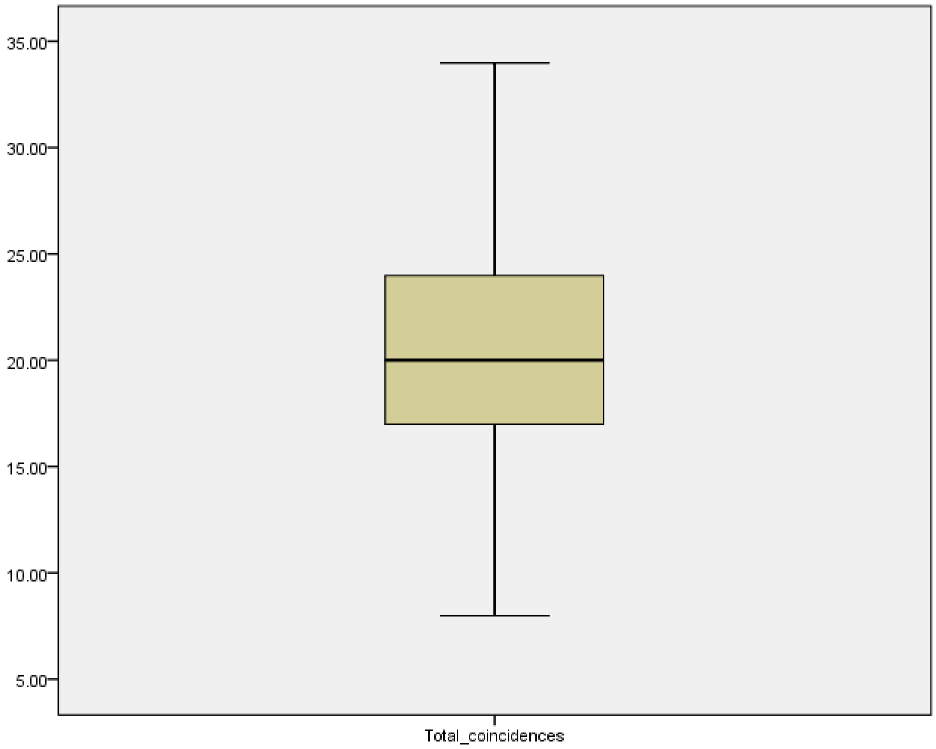
a. Lilliefors Significance Correction

Total_coincidences






Detrended Normal Q-Q Plot of Total_coincidences
Dev from Normal
Observed Value
0.4
0.3
0.2
0.1
0.0
-0.1
5
10
15
20
25
30
35


35.00
30.00
25.00
20.00
15.00
10.00
5.00
Total_coincidences

Chapter 7

Explore

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Number_of_correct_decisions	89	100.0%	0	0.0%	89	100.0%
Number_of_incorrect_decisions	89	100.0%	0	0.0%	89	100.0%
Number_of_correct_rejections	89	100.0%	0	0.0%	89	100.0%
Number_of_incorrect_rejections	89	100.0%	0	0.0%	89	100.0%

Descriptives

			Statistic	Std. Error
Number_of_correct_decisions	Mean		7.6292	.45463
	95% Confidence Interval for Mean	Lower Bound	6.7257	
		Upper Bound	8.5327	
	5% Trimmed Mean		7.4395	
	Median		7.0000	
	Variance		18.395	
	Std. Deviation		4.28894	
	Minimum		.00	
	Maximum		19.00	
	Range		19.00	
	Interquartile Range		5.00	
	Skewness		.665	.255
	Kurtosis		.652	.506
Number_of_incorrect_decisions	Mean		7.5393	.85041
	95% Confidence Interval for Mean	Lower Bound	5.8493	
		Upper Bound	9.2293	
	5% Trimmed Mean		6.3964	
	Median		6.0000	
	Variance		64.365	
	Std. Deviation		8.02277	
	Minimum		.00	
	Maximum		49.00	

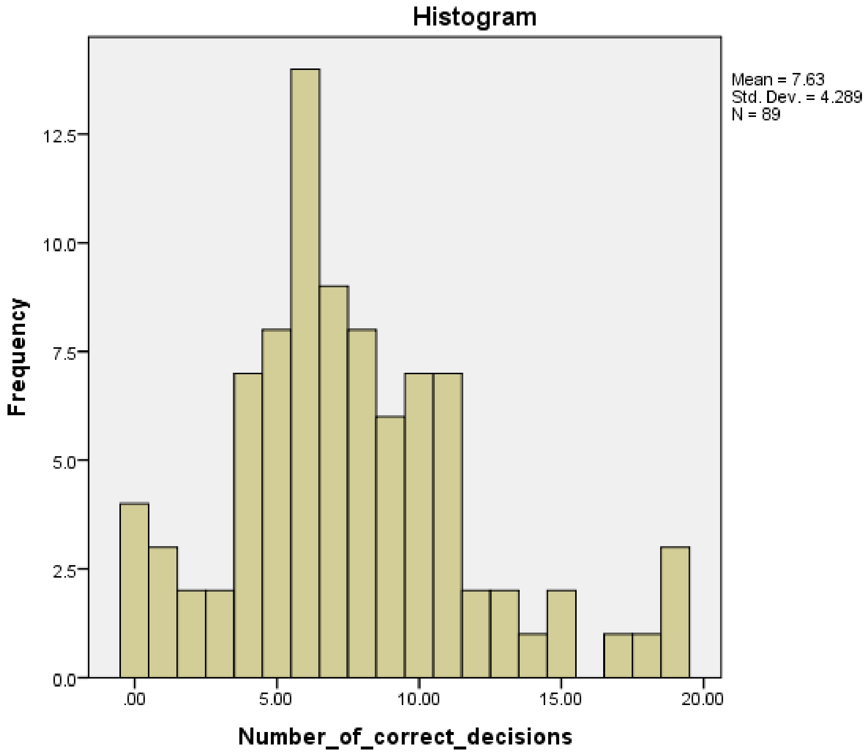
	Range		49.00	
	Interquartile Range		7.00	
	Skewness		3.172	.255
	Kurtosis		12.990	.506
Number_of_correct_rejections	Mean		24.8989	1.55081
	95% Confidence Interval for Mean	Lower Bound	21.8170	
		Upper Bound	27.9808	
	5% Trimmed Mean		24.9476	
	Median		28.0000	
	Variance		214.046	
	Std. Deviation		14.63033	
	Minimum		.00	
	Maximum		55.00	
	Range		55.00	
	Interquartile Range		21.00	
	Skewness		-.393	.255
	Kurtosis		-.861	.506
Number_of_incorrect_rejections	Mean		3.8315	.33030
	95% Confidence Interval for Mean	Lower Bound	3.1751	
		Upper Bound	4.4879	
	5% Trimmed Mean		3.6573	
	Median		3.0000	
	Variance		9.710	
	Std. Deviation		3.11607	
	Minimum		.00	
	Maximum		14.00	
	Range		14.00	
	Interquartile Range		5.00	
	Skewness		.709	.255
	Kurtosis		.003	.506

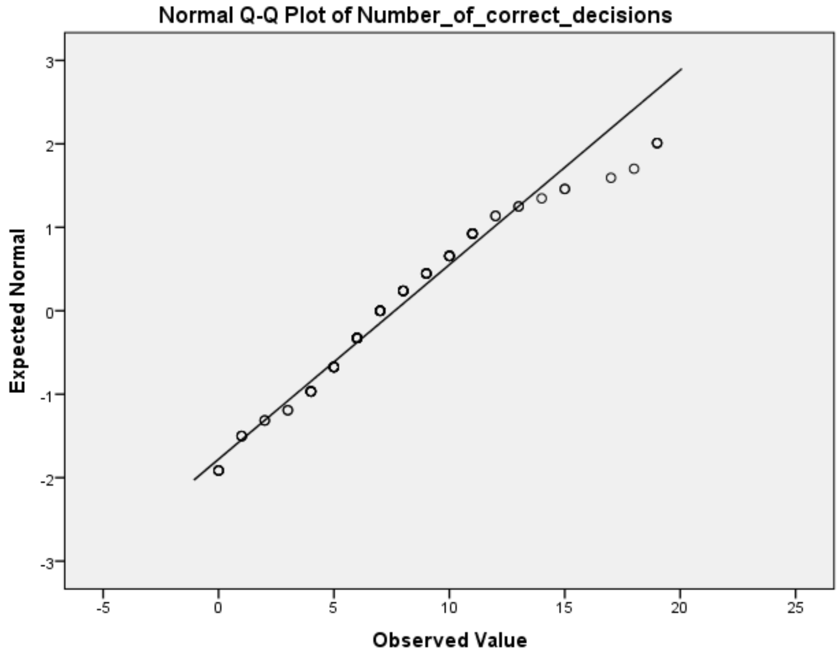
Tests of Normality

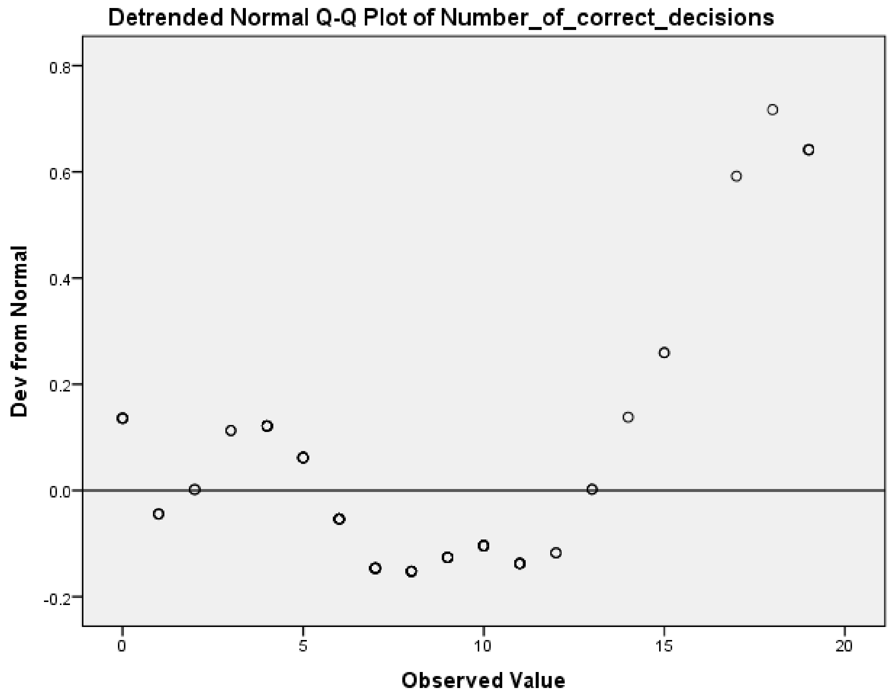
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Number_of_correct_decisions	.109	89	.011	.953	89	.003
Number_of_incorrect_decisions	.188	89	.000	.686	89	.000
Number_of_correct_rejections	.105	89	.017	.933	89	.000
Number_of_incorrect_rejections	.156	89	.000	.923	89	.000

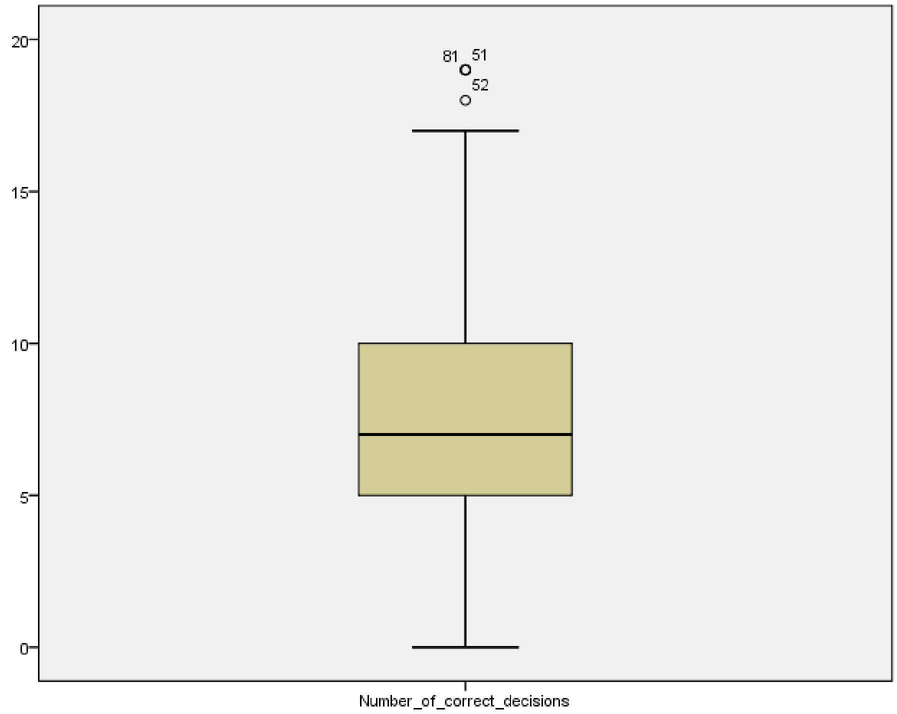
a. Lilliefors Significance Correction

Number_of_correct_decisions

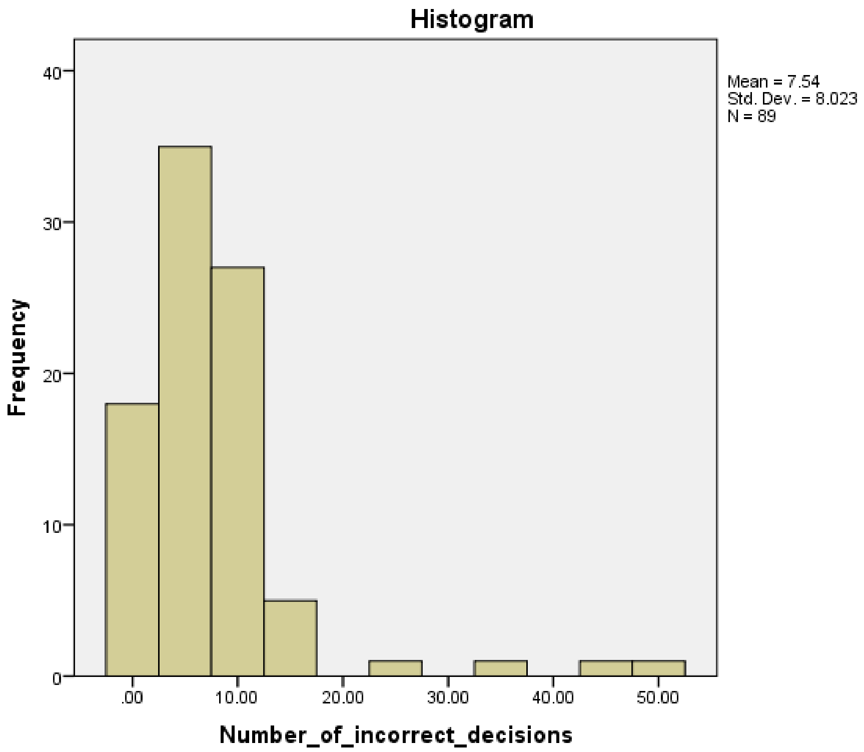


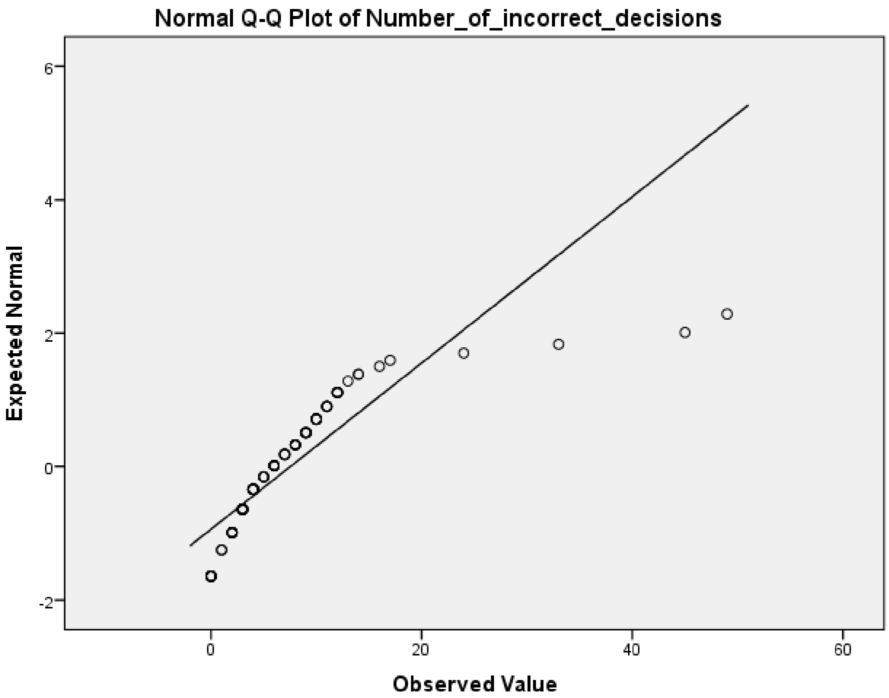


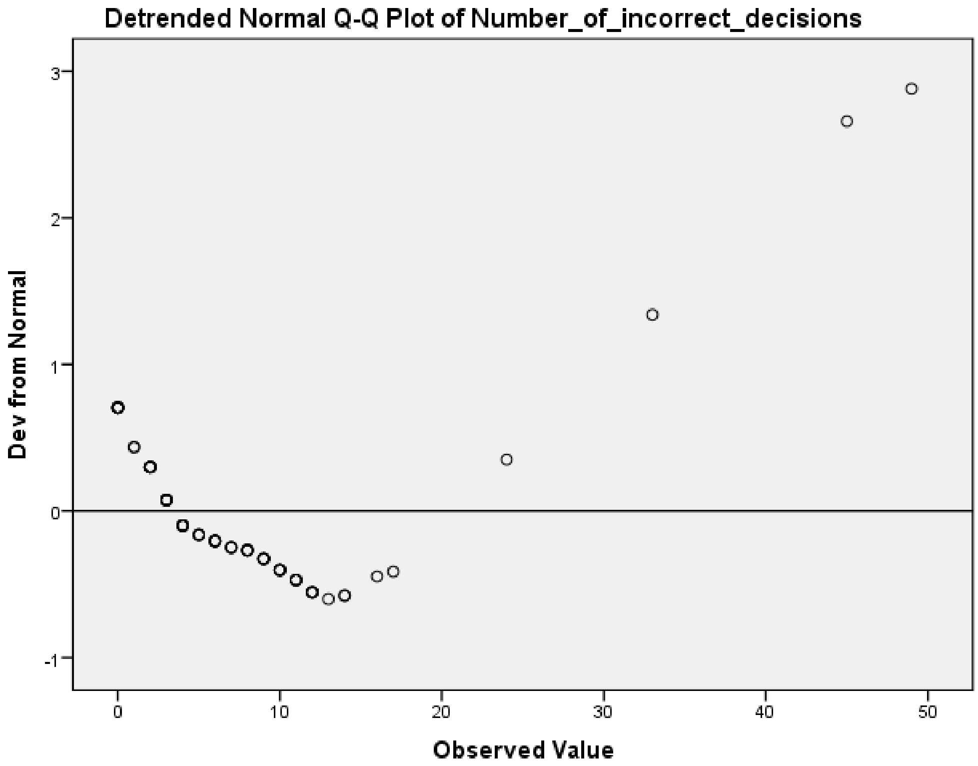

Detrended Normal Q-Q Plot of Number_of_correct_decisions
Dev from Normal
0.8
0.6
0.4
0.2
0.0
-0.2
0
5
10
15
20
Observed Value


20
15
10
5
0
81
51
52
Number_of_correct_decisions

Number_of_incorrect_decisions



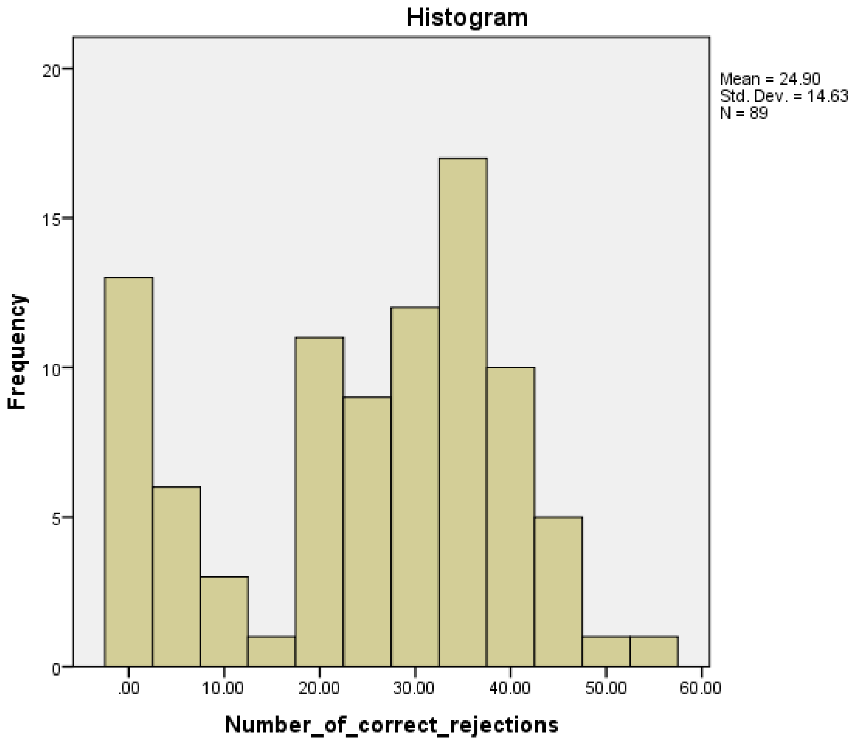


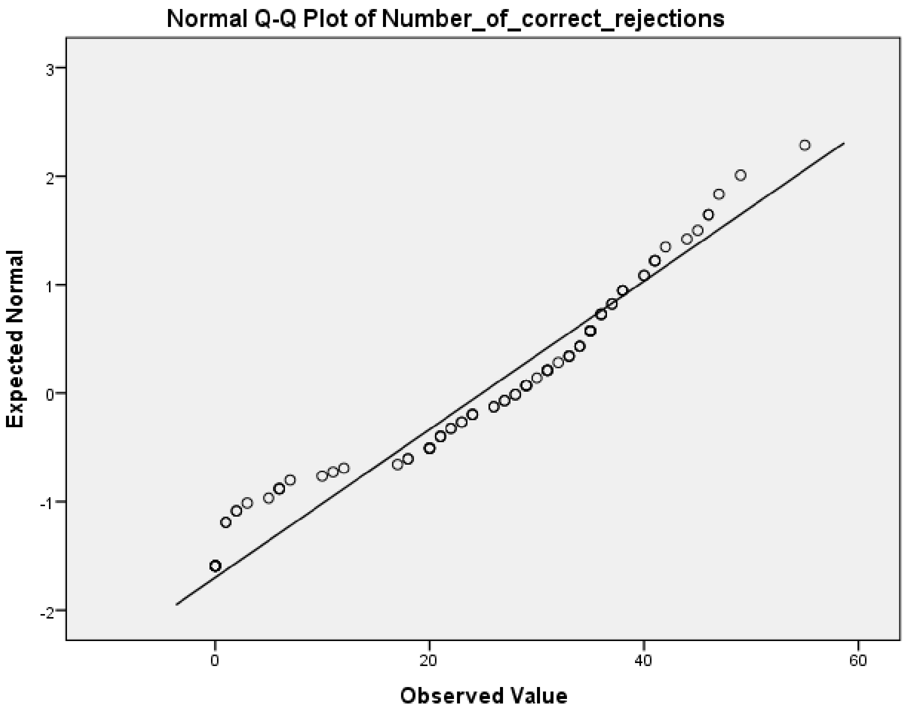


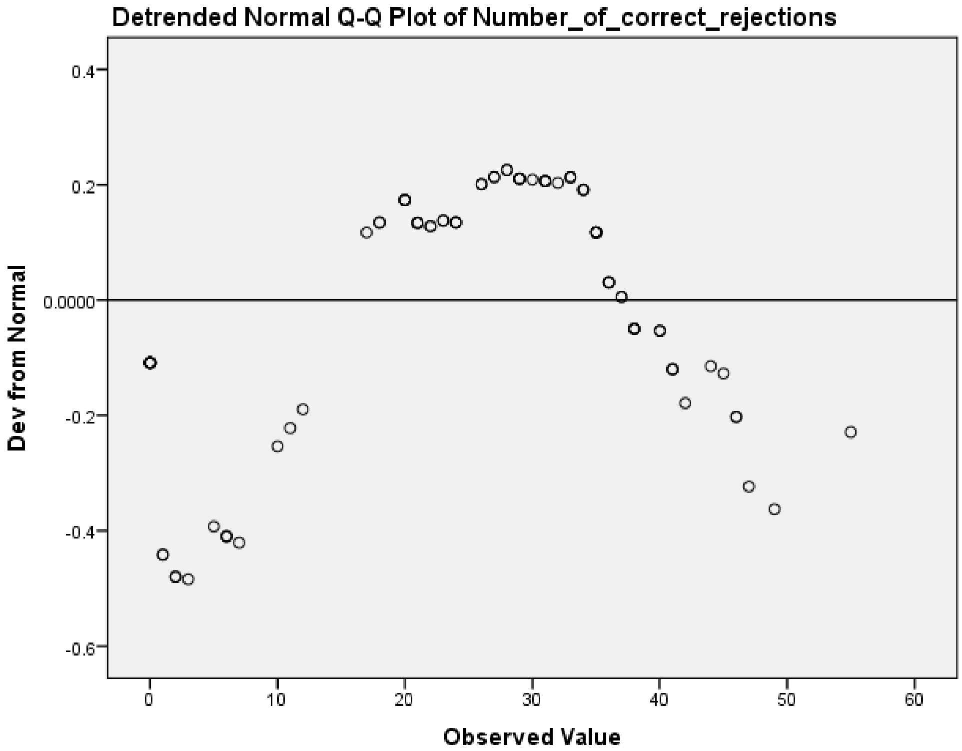
Detrended Normal Q-Q Plot of Number_of_incorrect_decisions
Dev from Normal
Observed Value
3
2
1
0
-1
0
10
20
30
40
50

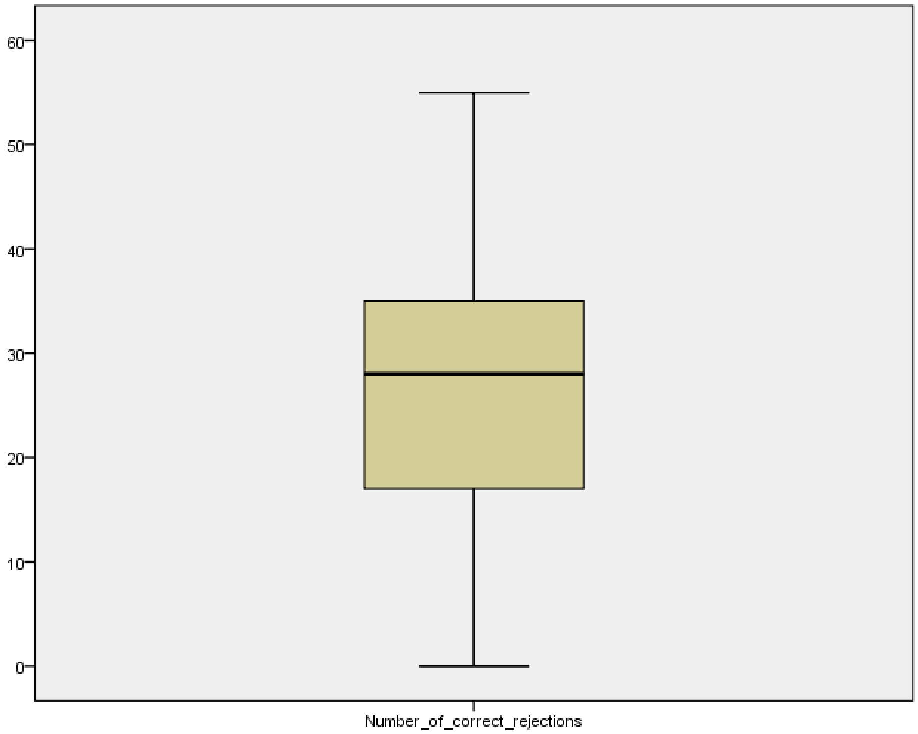
85
11
74
81
50
40
30
20
10
0
Number_of_incorrect_decisions

Number_of_correct_rejections

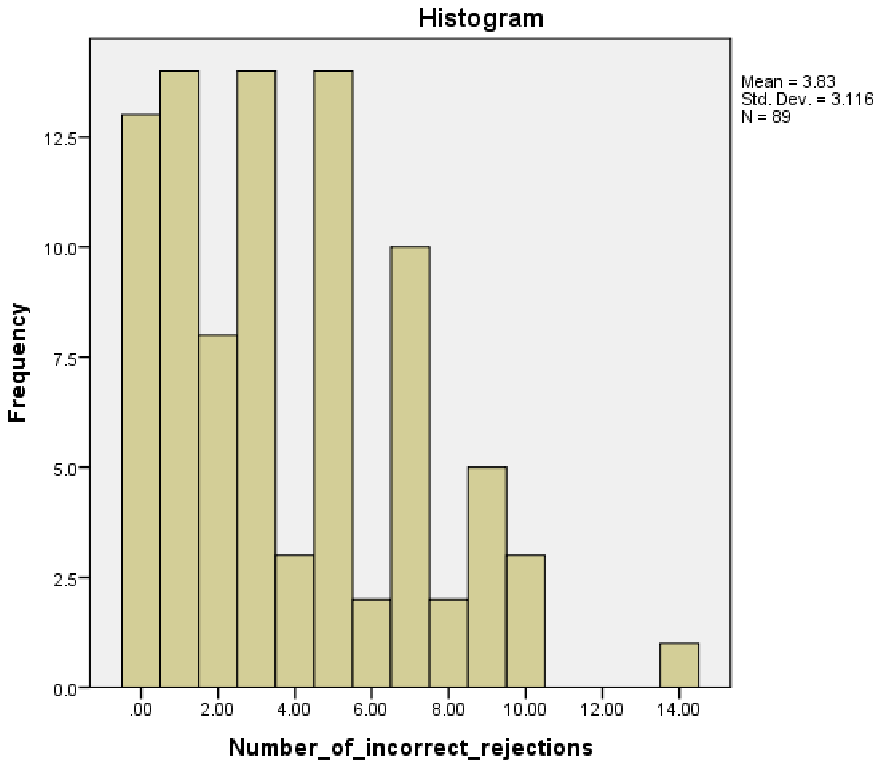


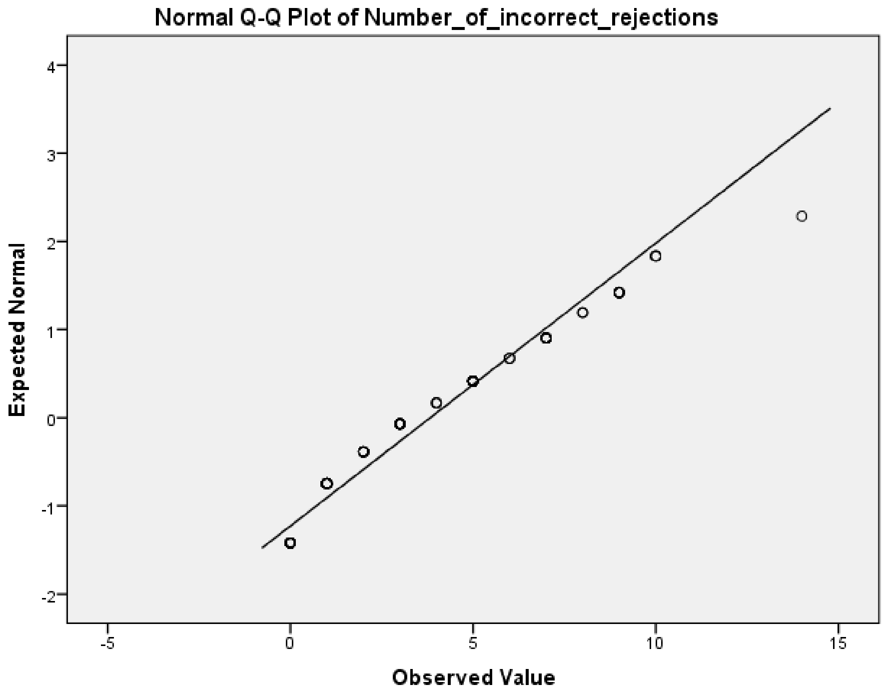


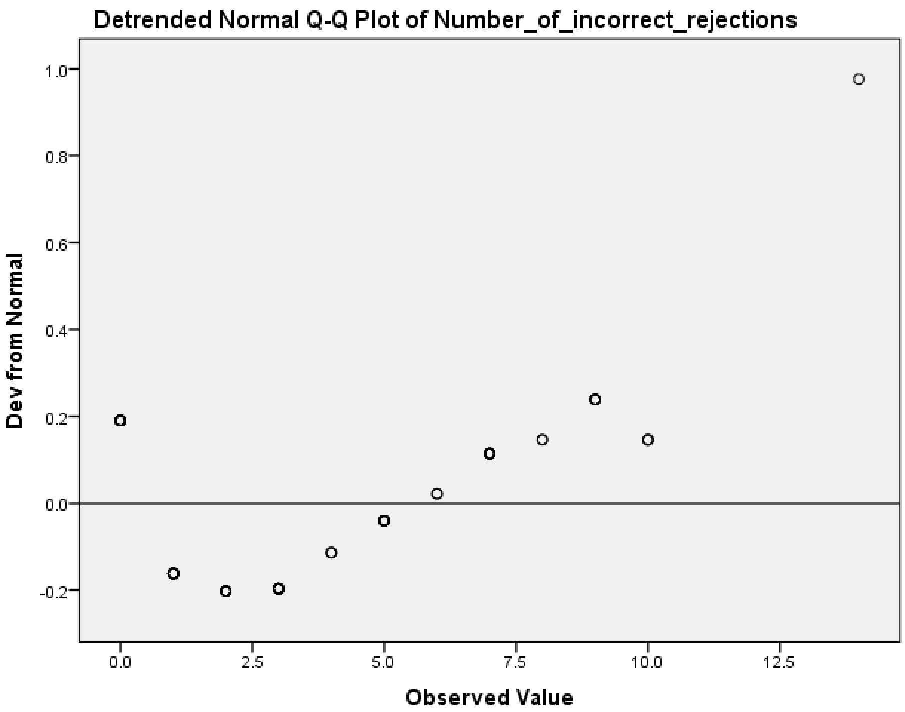

Detrended Normal Q-Q Plot of Number_of_correct_rejections
Dev from Normal
0.4
0.2
0.0000
-0.2
-0.4
-0.6
0
10
20
30
40
50
60
Observed Value

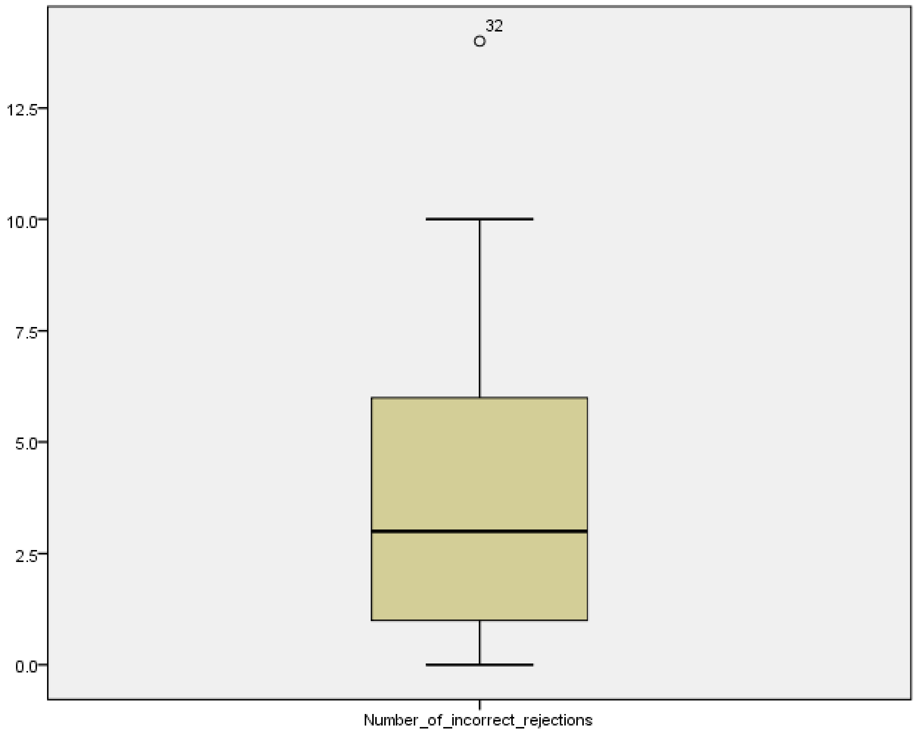

60
50
40
30
20
10
0
Number_of_correct_rejections

Number_of_incorrect_rejections






Detrended Normal Q-Q Plot of Number_of_incorrect_rejections
Dev from Normal
Observed Value


32
Number_of_incorrect_rejections

NPar Tests

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
Number_of_correct_decisions	89	7.6292	4.28894	.00	19.00
Number_of_incorrect_decisions	89	7.5393	8.02277	.00	49.00
Number_of_correct_rejections	89	24.8989	14.63033	.00	55.00
Number_of_incorrect_rejections	89	3.8315	3.11607	.00	14.00
Correct_decisions_mean_probability	84	83.8892	15.38848	34.60	100.00
Incorrect_decisions_mean_probability	78	71.1091	18.74255	16.60	100.00
Correct_decisions_minimum	84	65.3571	25.33850	10.00	100.00
Incorrect_decisions_minimum	78	53.2051	26.30953	10.00	100.00
Correct_rejection_mean_probability	82	20.1118	16.04389	.00	90.63
Incorrect_rejection_mean_probability	79	23.8914	17.31624	.00	87.70
Correct_rejection_maximum	82	39.5122	24.43952	.00	100.00
Incorrect_rejection_maximum	79	32.2785	23.09120	.00	100.00
PDI_Group	89	1.4944	.50280	1.00	2.00

Mann-Whitney Test

Ranks

	PDI_Group	N	Mean Rank	Sum of Ranks
Number_of_correct_decisions	Low	45	43.58	1961.00
	High	44	46.45	2044.00
	Total	89		
Number_of_incorrect_decisions	Low	45	50.30	2263.50
	High	44	39.58	1741.50
	Total	89		
Number_of_correct_rejections	Low	45	42.40	1908.00
	High	44	47.66	2097.00
	Total	89		
Number_of_incorrect_rejections	Low	45	44.38	1997.00
	High	44	45.64	2008.00
	Total	89		
Correct_decisions_mean_probability	Low	44	41.42	1822.50
	High	40	43.69	1747.50
	Total	84		
Incorrect_decisions_mean_probability	Low	41	38.94	1596.50
	High	37	40.12	1484.50
	Total	78		
Correct_decisions_minimum	Low	44	42.42	1866.50
	High	40	42.59	1703.50
	Total	84		
Incorrect_decisions_minimum	Low	41	37.34	1531.00
	High	37	41.89	1550.00
	Total	78		
Correct_rejection_mean_probability	Low	43	42.81	1841.00
	High	39	40.05	1562.00
	Total	82		
Incorrect_rejection_mean_probability	Low	41	39.94	1637.50
	High	38	40.07	1522.50
	Total	79		
Correct_rejection_maximum	Low	43	42.30	1819.00
	High	39	40.62	1584.00
	Total	82		
Incorrect_rejection_maximum	Low	41	38.84	1592.50
	High	38	41.25	1567.50
	Total	79		

Test Statistics[a]

	Number_of_correct_decisions	Number_of_incorrect_decisions	Number_of_correct_rejections	Number_of_incorrect_rejections
Mann-Whitney U	926.000	751.500	873.000	962.000
Wilcoxon W	1961.000	1741.500	1908.000	1997.000
Z	-.527	-1.963	-.961	-.232
Asymp. Sig. (2-tailed)	.598	.050	.337	.817

a. Grouping Variable: PDI_Group

Test Statistics[a]

	Correct_decisions_mean_probability	Incorrect_decisions_mean_probability	Correct_decisions_minimum	Incorrect_decisions_minimum	Correct_rejection_mean_probability	Incorrect_rejection_mean_probability	Correct_rejection_maximum	Incorrect_rejection_maximum
Mann-Whitney U	832.500	735.500	876.500	670.000	782.000	776.500	804.000	731.500
Wilcoxon W	1822.500	1596.500	1866.500	1531.000	1562.000	1637.500	1584.000	1592.500
Z	-.426	-.230	-.032	-.898	-.525	-.025	-.324	-.476
Asymp. Sig. (2-tailed)	.670	.818	.975	.369	.600	.980	.746	.634

a. Grouping Variable: PDI_Group

Chapter 8

Explore

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Narratives_Overall	83	100.0%	0	0.0%	83	100.0%

Descriptives

			Statistic	Std. Error
Narratives_Overall	Mean		4.5060	.10425
	95% Confidence Interval for Mean	Lower Bound	4.2986	
		Upper Bound	4.7134	
	5% Trimmed Mean		4.4724	
	Median		4.3611	
	Variance		.902	
	Std. Deviation		.94978	
	Minimum		2.58	
	Maximum		7.14	
	Range		4.56	
	Interquartile Range		1.11	
	Skewness		.442	.264
	Kurtosis		.350	.523

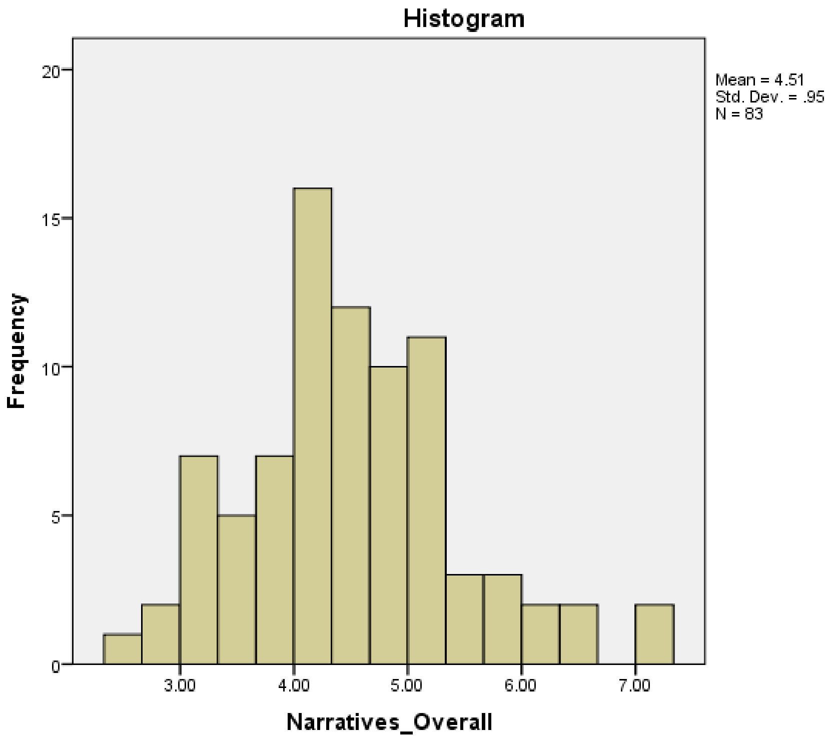
Tests of Normality

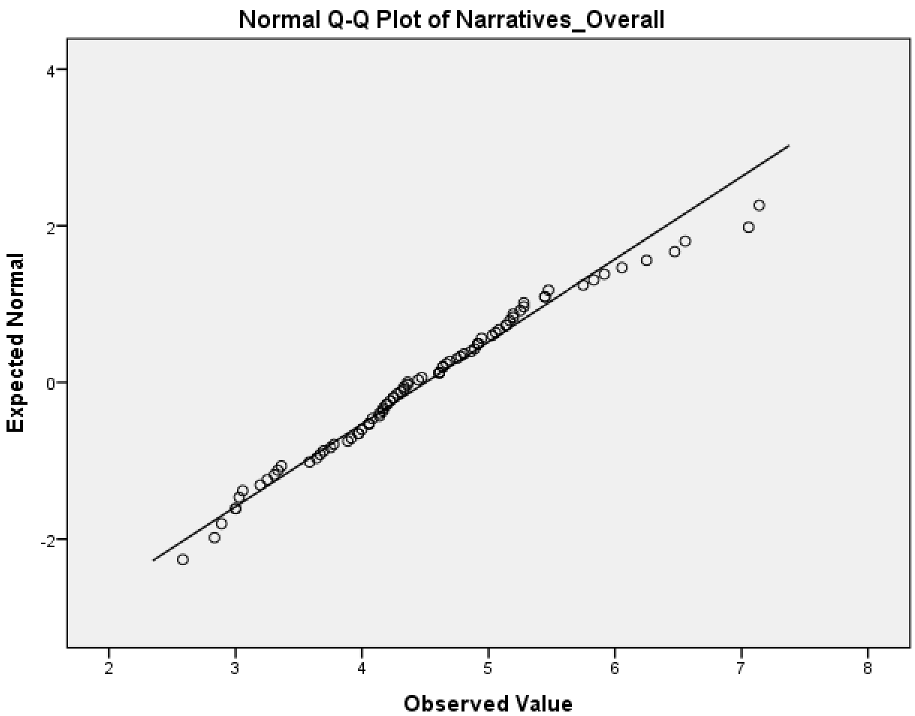
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Narratives_Overall	.067	83	.200*	.979	83	.183

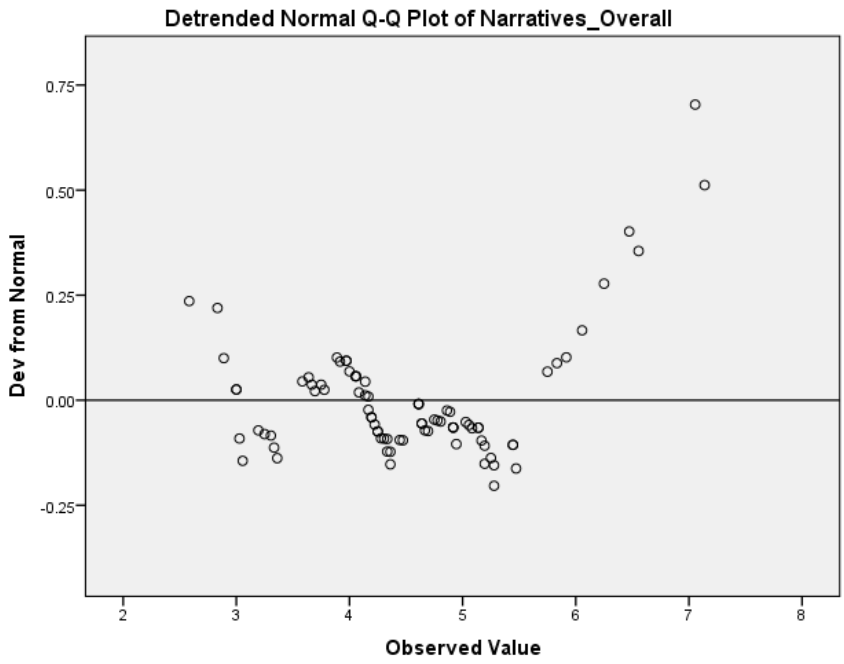
*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

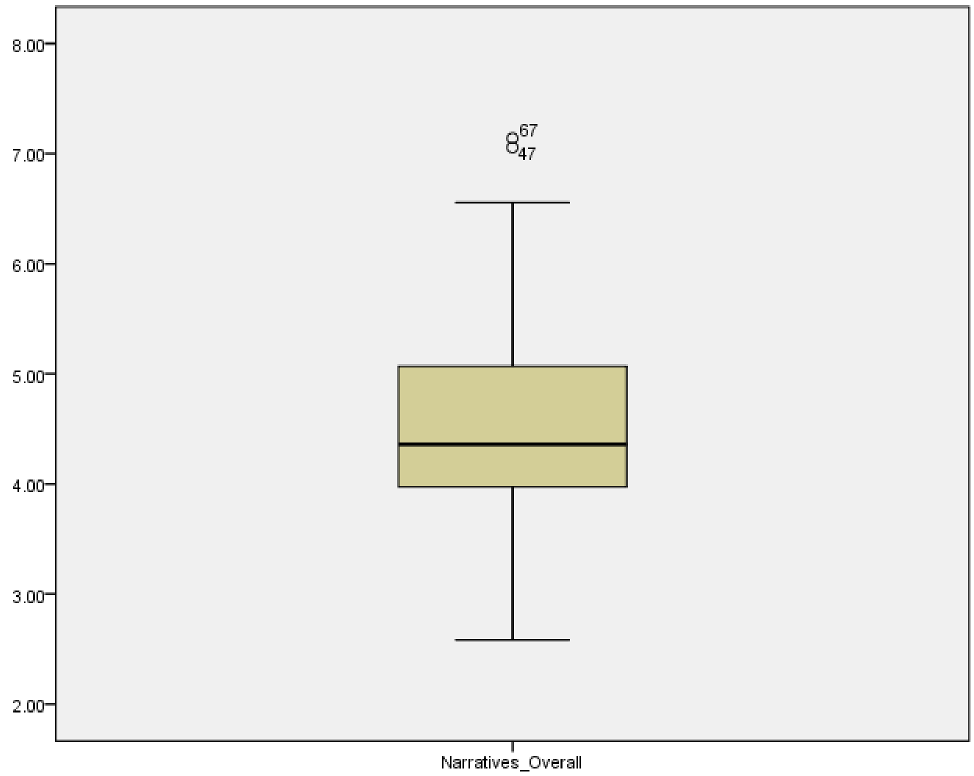
Narratives_Overall







Detrended Normal Q-Q Plot of Narratives_Overall
Dev from Normal
0.75
0.50
0.25
0.00
-0.25
2
3
4
5
6
7
8
Observed Value



8.00
7.00
6.00
5.00
4.00
3.00
2.00
67
47
Narratives_Overall

Thematic Apperception Test – total number of interpretations

Explore

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Poor_interpretation_total	83	100.0%	0	0.0%	83	100.0%
Possible_interpretation_total	83	100.0%	0	0.0%	83	100.0%
Good_interpretation_total	83	100.0%	0	0.0%	83	100.0%
Excellent_interpretation_total	83	100.0%	0	0.0%	83	100.0%

Descriptives

			Statistic	Std. Error
Poor_interpretation_total	Mean		7.0000	.45838
	95% Confidence Interval for Mean	Lower Bound	6.0881	
		Upper Bound	7.9119	
	5% Trimmed Mean		6.8487	
	Median		7.0000	
	Variance		17.439	
	Std. Deviation		4.17601	
	Minimum		.00	
	Maximum		19.00	
	Range		19.00	
	Interquartile Range		5.00	
	Skewness		.550	.264
	Kurtosis		.011	.523
Possible_interpretation_total	Mean		9.5542	.41541
	95% Confidence Interval for Mean	Lower Bound	8.7278	
		Upper Bound	10.3806	
	5% Trimmed Mean		9.4933	
	Median		9.0000	
	Variance		14.323	
	Std. Deviation		3.78461	
	Minimum		.00	
	Maximum		21.00	

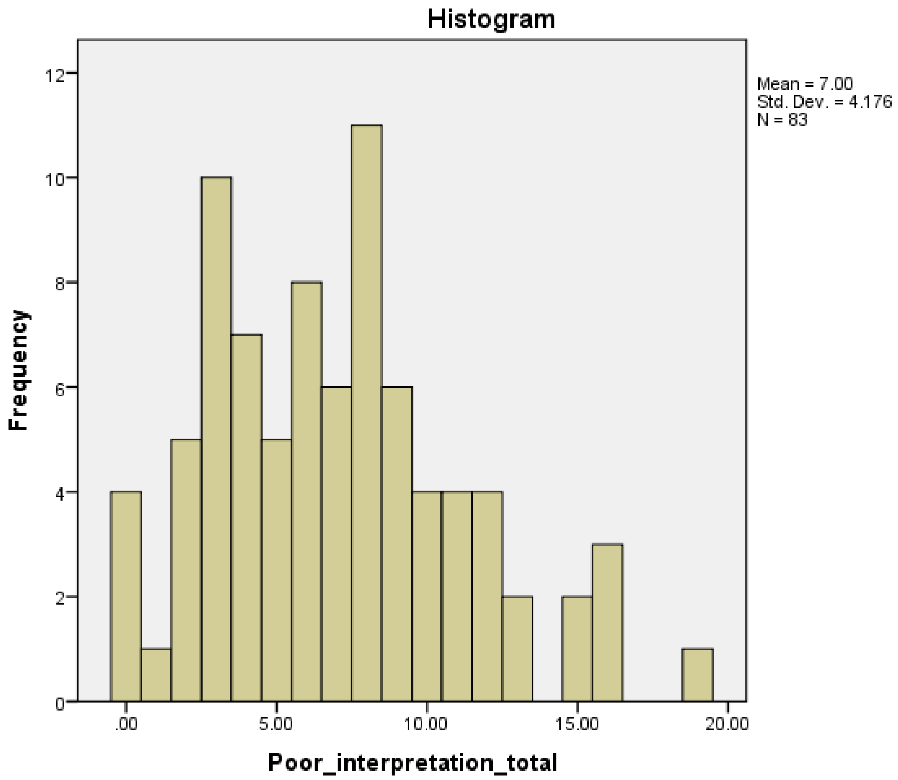
	Range		21.00	
	Interquartile Range		5.00	
	Skewness		.261	.264
	Kurtosis		1.281	.523
Good_interpretation_total	Mean		8.0482	.41352
	95% Confidence Interval for Mean	Lower Bound	7.2256	
		Upper Bound	8.8708	
	5% Trimmed Mean		7.9980	
	Median		8.0000	
	Variance		14.193	
	Std. Deviation		3.76733	
	Minimum		.00	
	Maximum		18.00	
	Range		18.00	
	Interquartile Range		4.00	
	Skewness		.126	.264
	Kurtosis		.376	.523
Excellent_interpretation_total	Mean		1.8795	.28499
	95% Confidence Interval for Mean	Lower Bound	1.3126	
		Upper Bound	2.4465	
	5% Trimmed Mean		1.5656	
	Median		1.0000	
	Variance		6.741	
	Std. Deviation		2.59642	
	Minimum		.00	
	Maximum		13.00	
	Range		13.00	
	Interquartile Range		3.00	
	Skewness		1.802	.264
	Kurtosis		3.693	.523

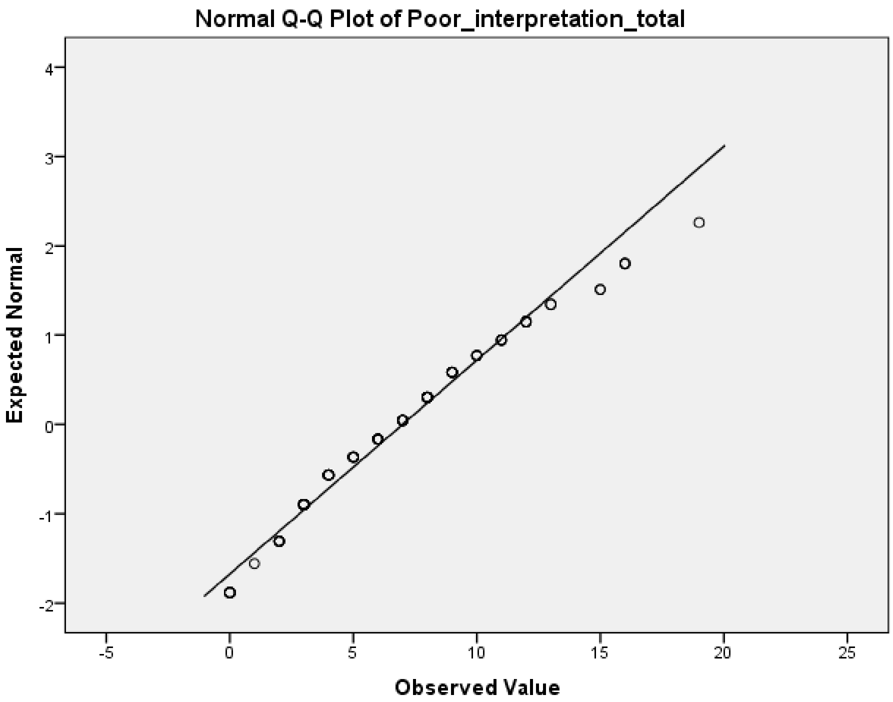
Tests of Normality

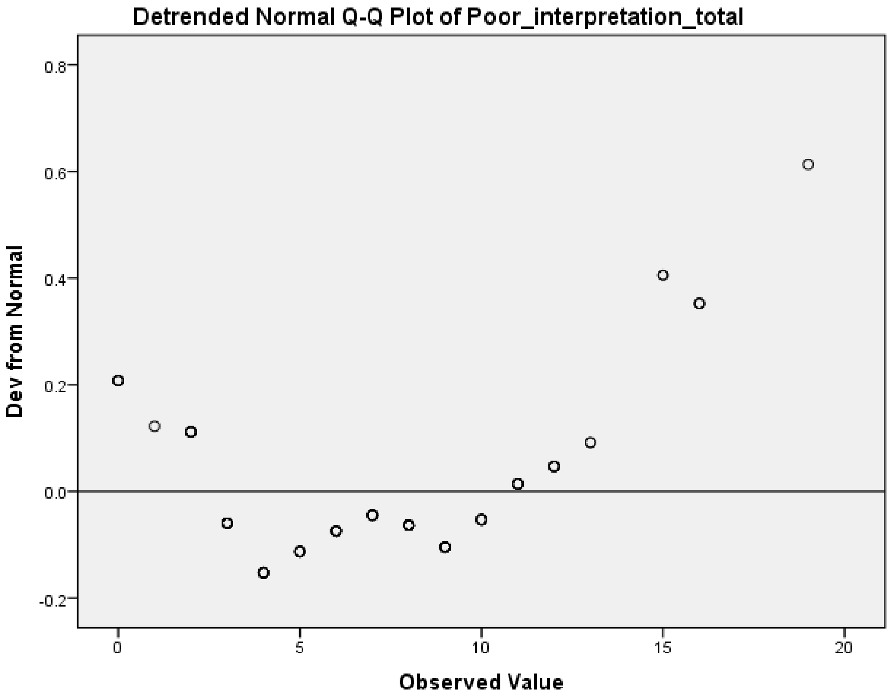
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Poor_interpretation_total	.092	83	.079	.966	83	.026
Possible_interpretation_total	.117	83	.007	.963	83	.018
Good_interpretation_total	.089	83	.159	.974	83	.097
Excellent_interpretation_total	.235	83	.000	.752	83	.000

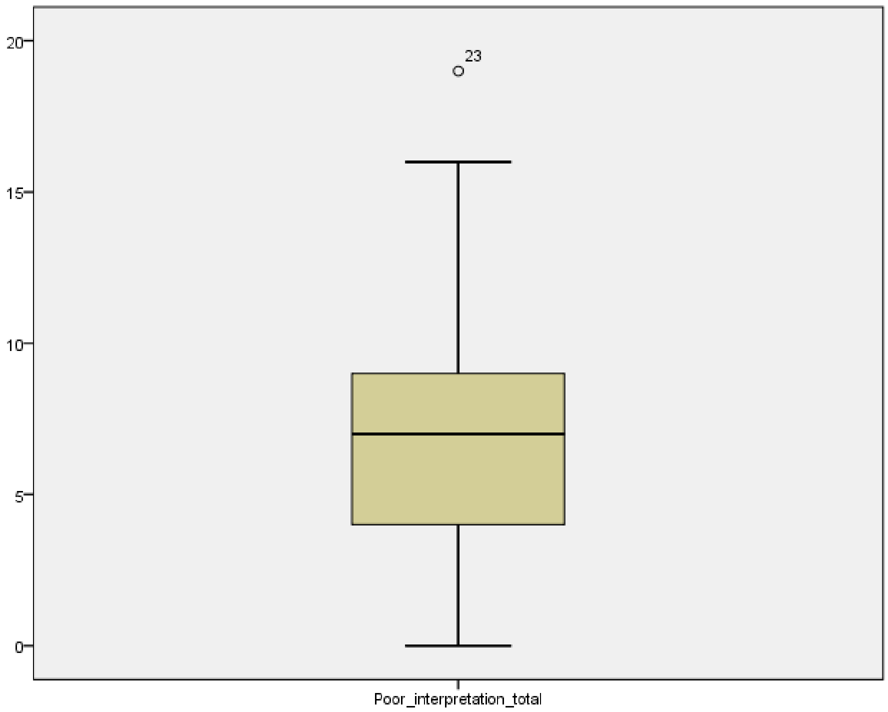
a. Lilliefors Significance Correction

Poor_interpretation_total

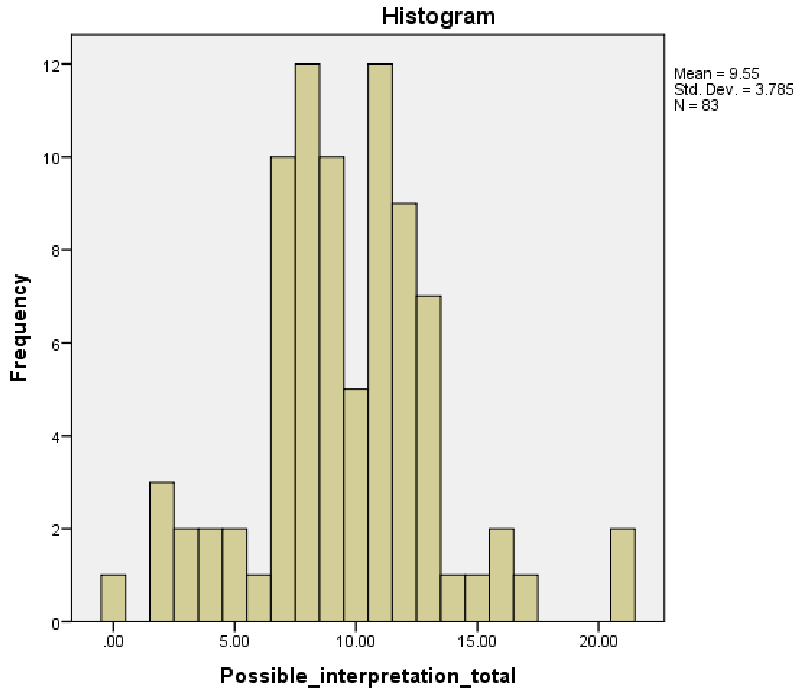


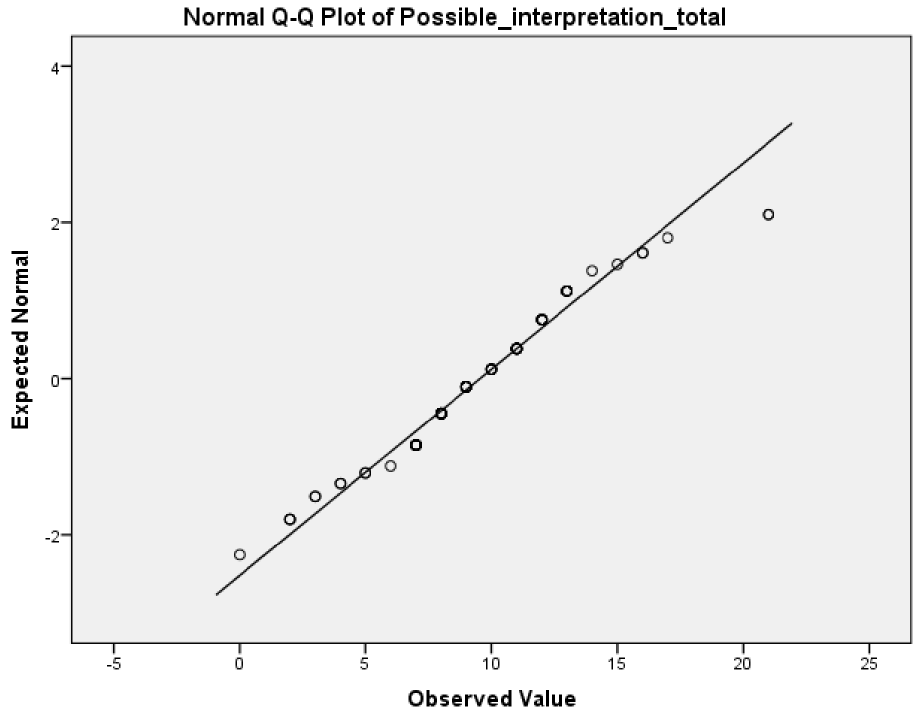


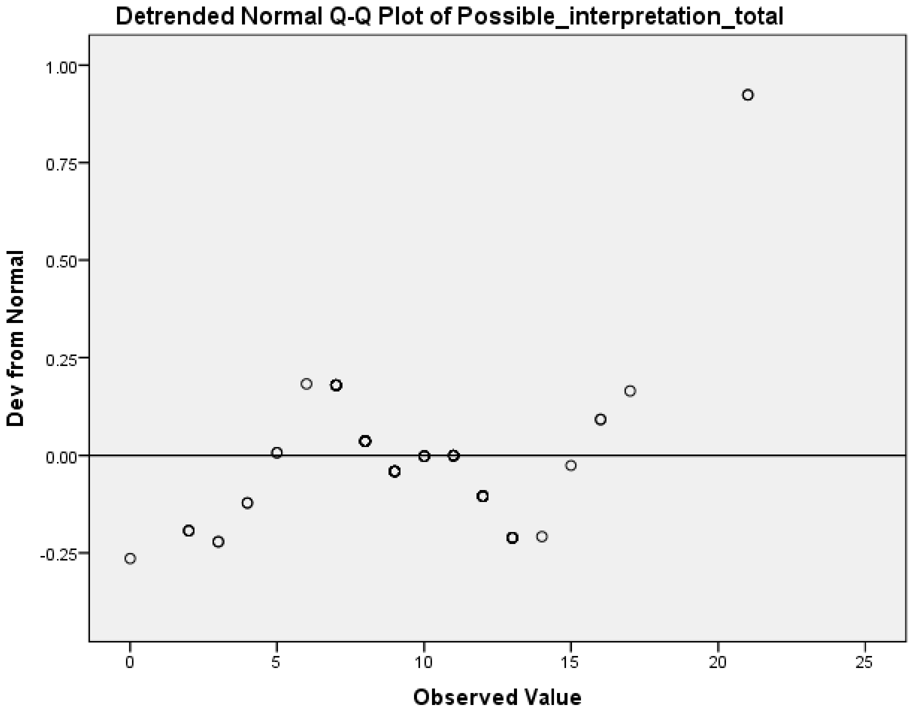

Detrended Normal Q-Q Plot of Poor_interpretation_total
0.8
0.6
0.4
0.2
0.0
-0.2
Dev from Normal
0
5
10
15
20
Observed Value


20
15
10
5
0
23
Poor_interpretation_total

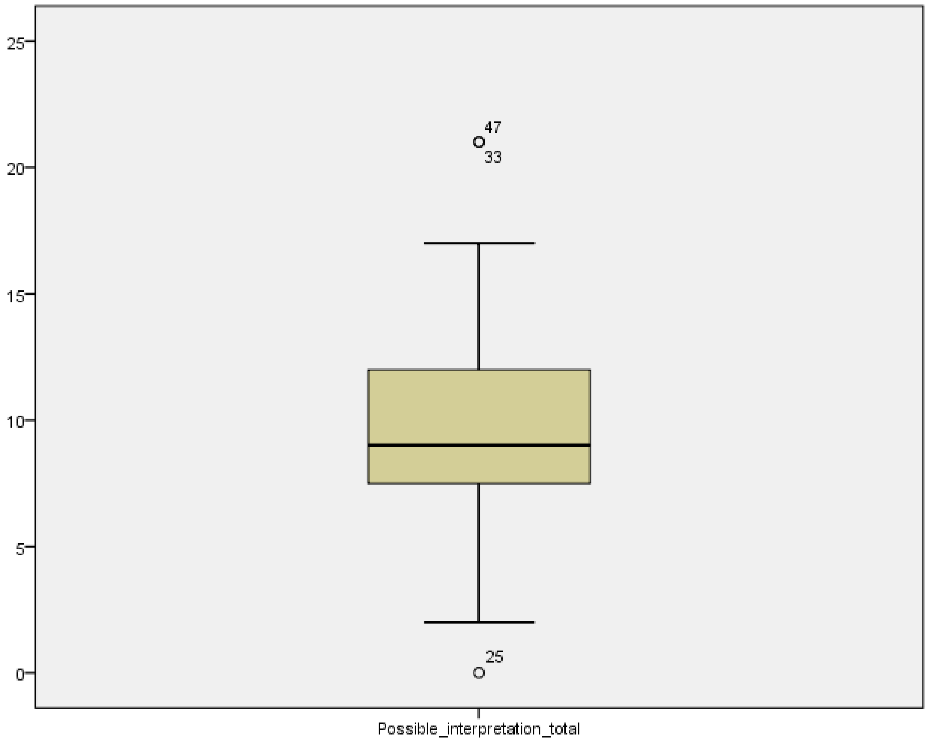
Possible_interpretation_total





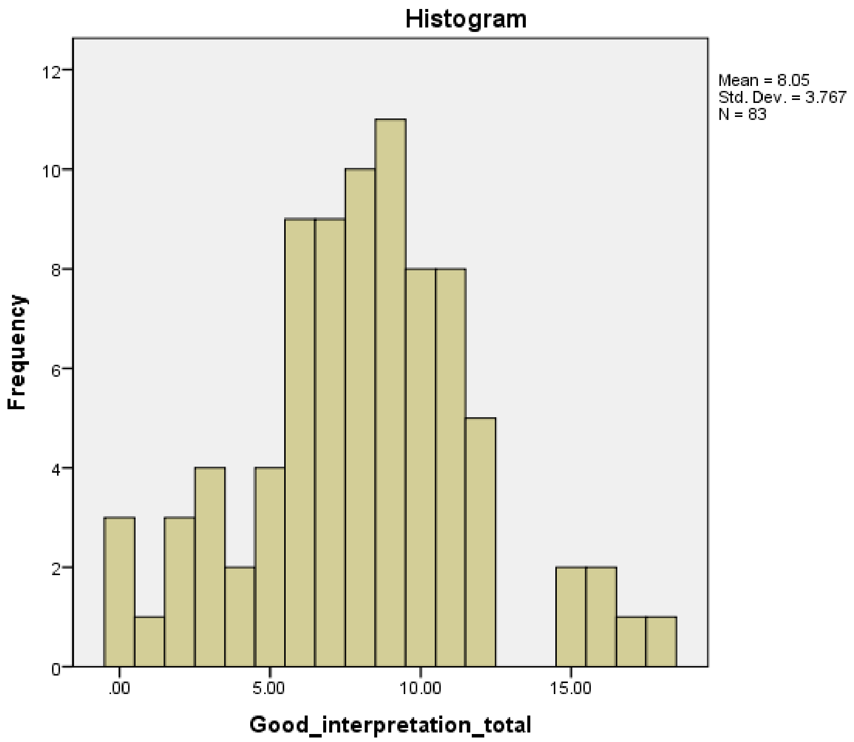


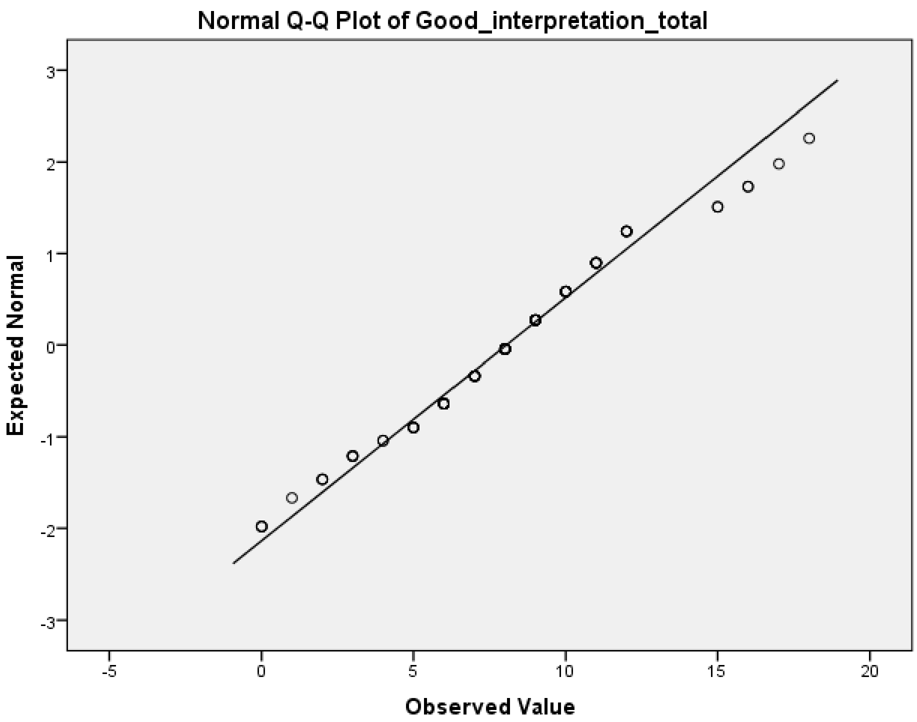
Detrended Normal Q-Q Plot of Possible_interpretation_total
Dev from Normal
1.00
0.75
0.50
0.25
0.00
-0.25
0
5
10
15
20
25
Observed Value

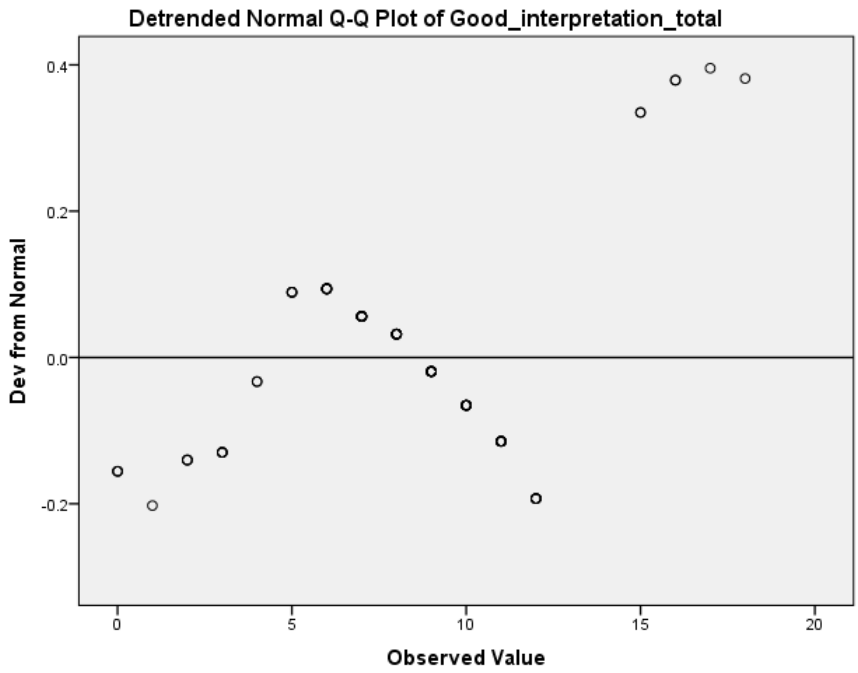


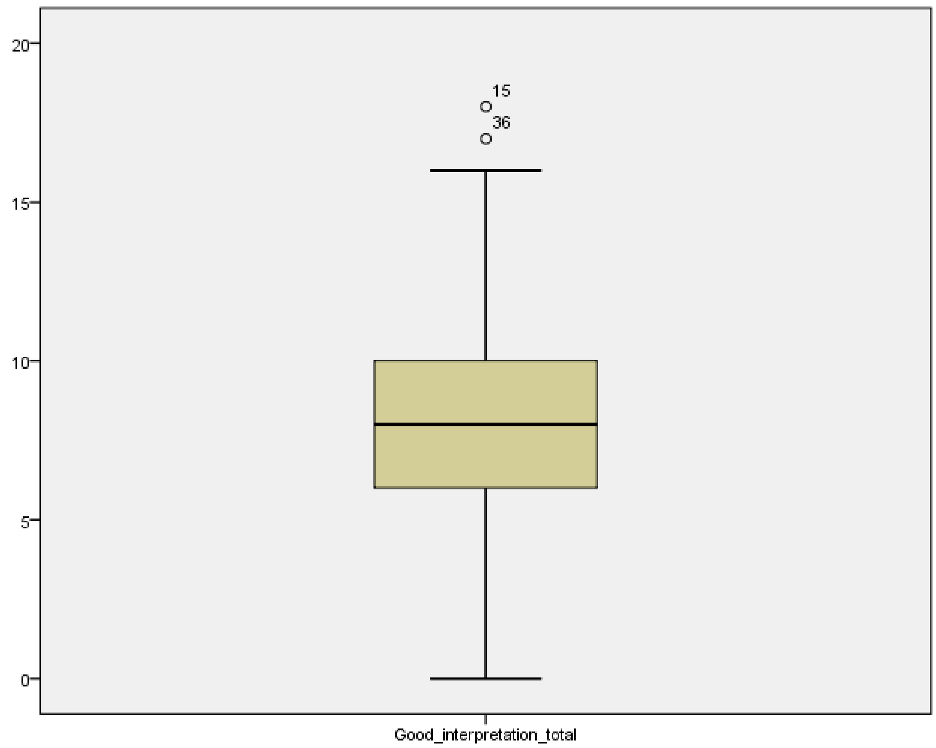
25
20
15
10
5
0
47
33
25
Possible_interpretation_total

Good_interpretation_total

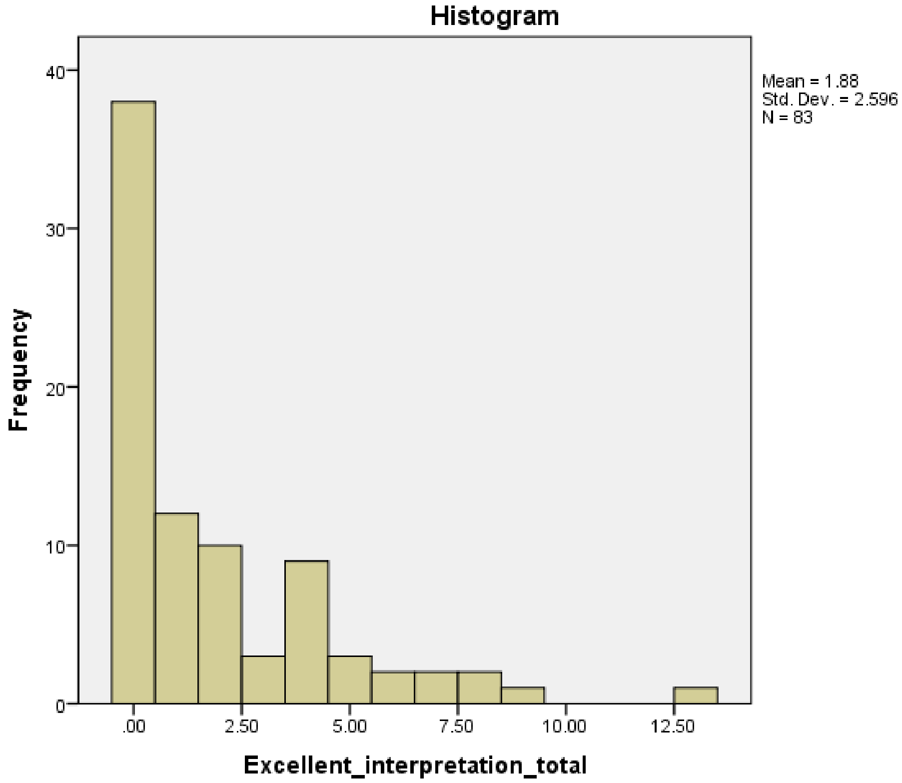


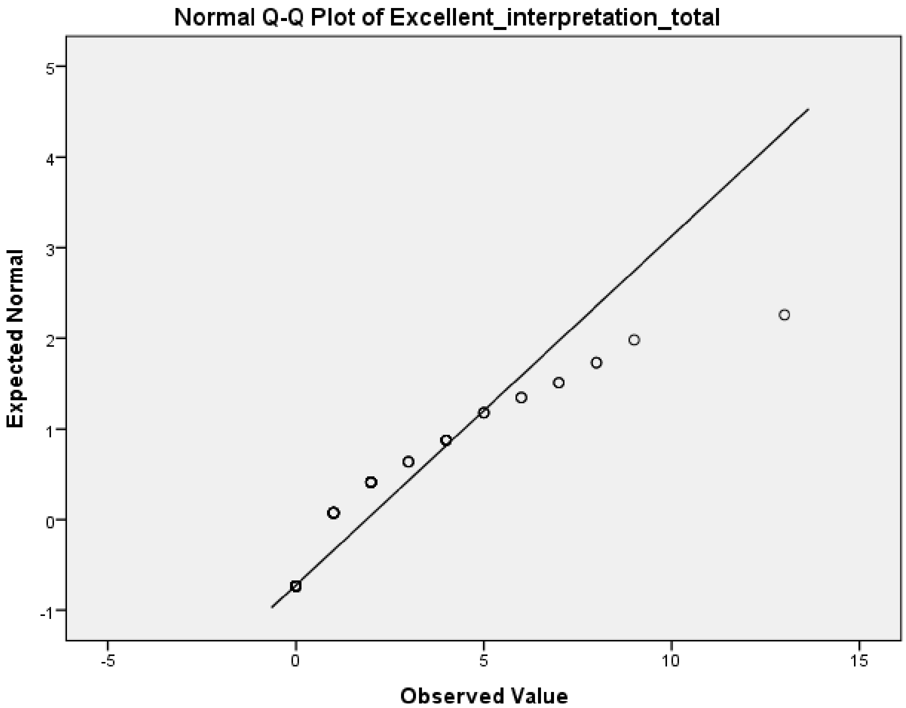


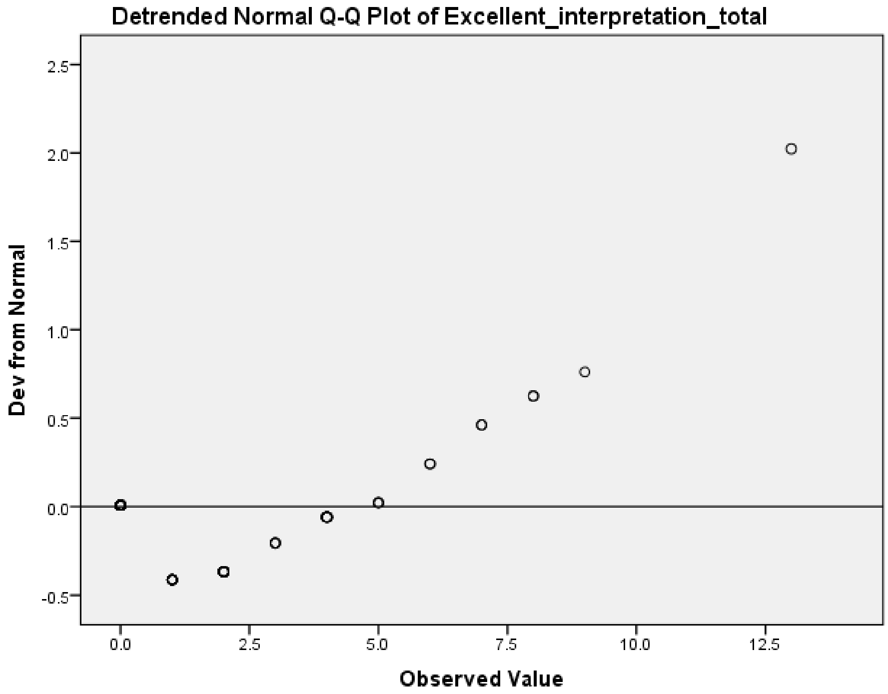

Detrended Normal Q-Q Plot of Good_interpretation_total
0.4
0.2
0.0
-0.2
Dev from Normal
0
5
10
15
20
Observed Value

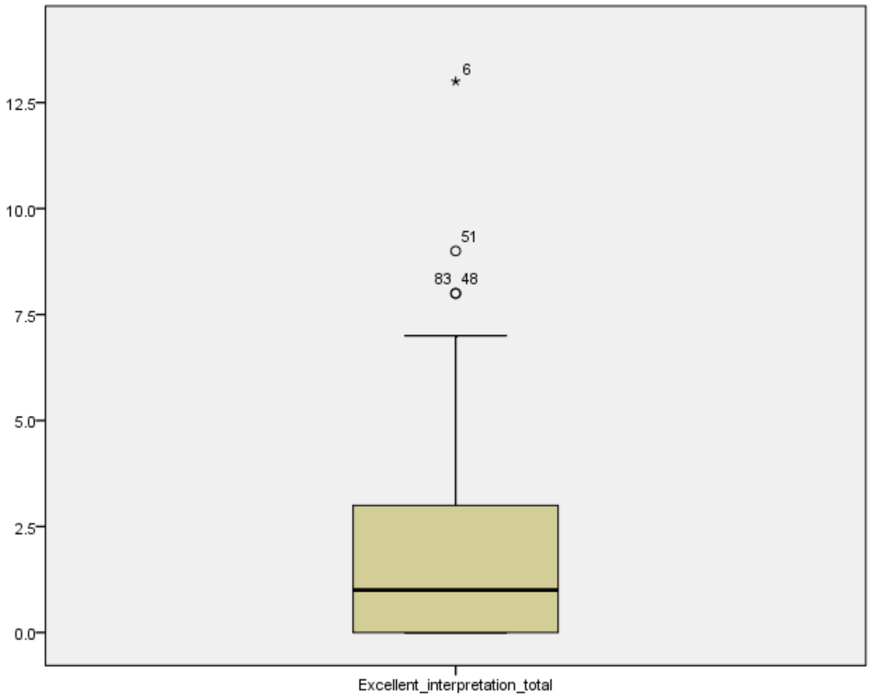

20
15
10
5
0
15
36
Good_interpretation_total

Excellent_interpretation_total






Detrended Normal Q-Q Plot of Excellent_interpretation_total
Dev from Normal
Observed Value
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
0.0
2.5
5.0
7.5
10.0
12.5


12.5
10.0
7.5
5.0
2.5
0.0
6
51
83
48
Excellent_interpretation_total

Thematic Apperception Test - 3 and 6 interpretations

Explore

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Poor_interpretation_3	83	100.0%	0	0.0%	83	100.0%
Possible_interpretation_3	83	100.0%	0	0.0%	83	100.0%
Good_interpretation_3	83	100.0%	0	0.0%	83	100.0%
Excellent_interpretation_3	83	100.0%	0	0.0%	83	100.0%
Poor_interpretation_6	83	100.0%	0	0.0%	83	100.0%
Possible_interpretation_6	83	100.0%	0	0.0%	83	100.0%
Good_interpretation_6	83	100.0%	0	0.0%	83	100.0%
Excellent_interpretation_6	83	100.0%	0	0.0%	83	100.0%

Descriptives

			Statistic	Std. Error
Poor_interpretation_3	Mean		2.0241	.17395
	95% Confidence Interval for Mean	Lower Bound	1.6780	
		Upper Bound	2.3701	
	5% Trimmed Mean		1.9311	
	Median		2.0000	
	Variance		2.512	
	Std. Deviation		1.58481	
	Minimum		.00	
	Maximum		7.00	
	Range		7.00	
	Interquartile Range		2.00	
	Skewness		.656	.264
	Kurtosis		.143	.523
Possible_interpretation_3	Mean		3.1084	.18622
	95% Confidence Interval for Mean	Lower Bound	2.7380	
		Upper Bound	3.4789	
	5% Trimmed Mean		3.0669	
	Median		3.0000	
	Variance		2.878	
	Std. Deviation		1.69657	
	Minimum		.00	

	Maximum		8.00	
	Range		8.00	
	Interquartile Range		2.00	
	Skewness		.364	.264
	Kurtosis		.236	.523
Good_interpretation_3	Mean		2.9880	.15380
	95% Confidence Interval for Mean	Lower Bound	2.6820	
		Upper Bound	3.2939	
	5% Trimmed Mean		3.0020	
	Median		3.0000	
	Variance		1.963	
	Std. Deviation		1.40117	
	Minimum		.00	
	Maximum		6.00	
	Range		6.00	
	Interquartile Range		2.00	
	Skewness		-.169	.264
	Kurtosis		-.080	.523
Excellent_interpretation_3	Mean		.7711	.11917
	95% Confidence Interval for Mean	Lower Bound	.5340	
		Upper Bound	1.0081	
	5% Trimmed Mean		.6633	
	Median		.0000	
	Variance		1.179	
	Std. Deviation		1.08566	
	Minimum		.00	
	Maximum		4.00	
	Range		4.00	
	Interquartile Range		1.00	
	Skewness		1.351	.264
	Kurtosis		.902	.523
Poor_interpretation_6	Mean		4.9759	.33151
	95% Confidence Interval for Mean	Lower Bound	4.3164	
		Upper Bound	5.6354	
	5% Trimmed Mean		4.8621	
	Median		5.0000	
	Variance		9.121	
	Std. Deviation		3.02016	
	Minimum		.00	
	Maximum		13.00	
	Range		13.00	

	Interquartile Range		5.00	
	Skewness		.516	.264
	Kurtosis		-.111	.523
Possible_interpretation_6	Mean		6.4458	.29205
	95% Confidence Interval for Mean	Lower Bound	5.8648	
		Upper Bound	7.0268	
	5% Trimmed Mean		6.4284	
	Median		7.0000	
	Variance		7.079	
	Std. Deviation		2.66070	
	Minimum		.00	
	Maximum		14.00	
	Range		14.00	
	Interquartile Range		3.00	
	Skewness		.086	.264
	Kurtosis		.527	.523
Good_interpretation_6	Mean		5.0602	.31671
	95% Confidence Interval for Mean	Lower Bound	4.4302	
		Upper Bound	5.6903	
	5% Trimmed Mean		4.9598	
	Median		5.0000	
	Variance		8.326	
	Std. Deviation		2.88541	
	Minimum		.00	
	Maximum		13.00	
	Range		13.00	
	Interquartile Range		4.00	
	Skewness		.382	.264
	Kurtosis		.151	.523
Excellent_interpretation_6	Mean		1.1084	.19167
	95% Confidence Interval for Mean	Lower Bound	.7271	
		Upper Bound	1.4897	
	5% Trimmed Mean		.9003	
	Median		.0000	
	Variance		3.049	
	Std. Deviation		1.74616	
	Minimum		.00	
	Maximum		9.00	
	Range		9.00	
	Interquartile Range		2.00	

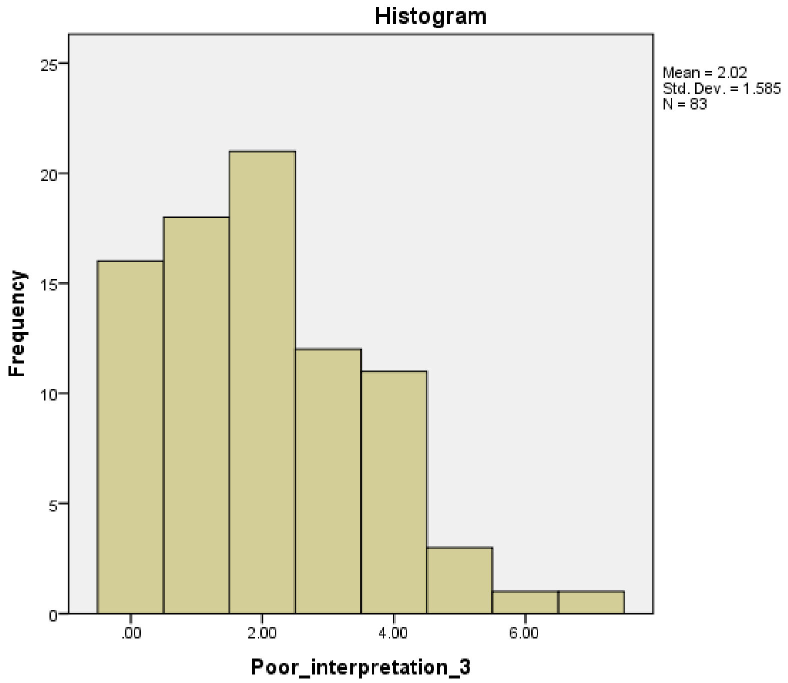
	Skewness	1.971	.264
	Kurtosis	4.493	.523

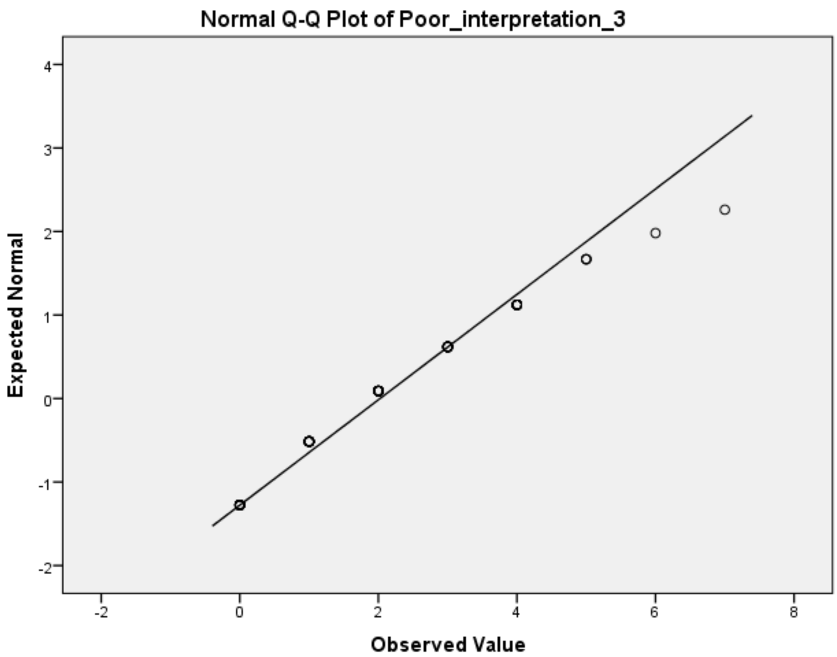
Tests of Normality

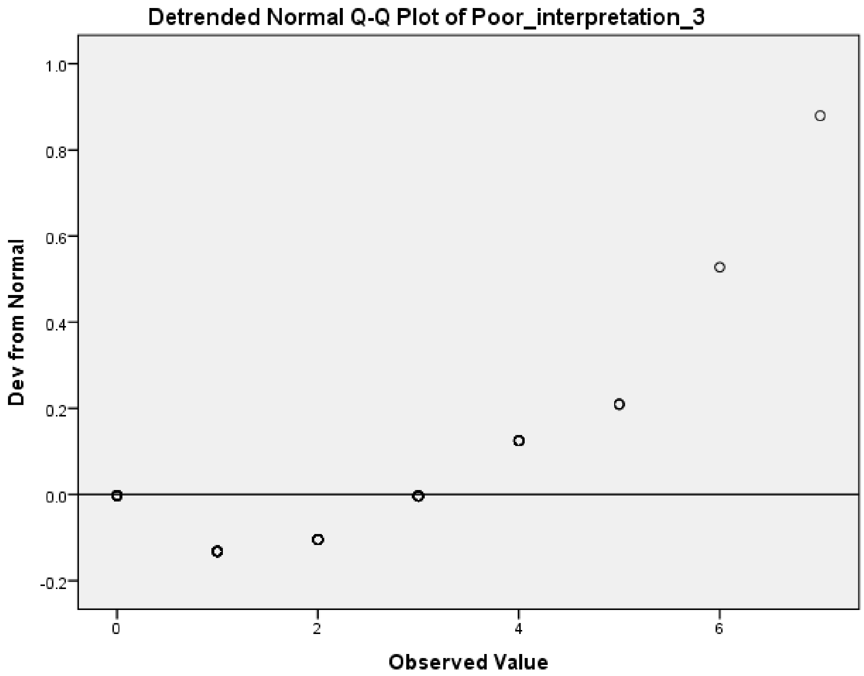
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Poor_interpretation_3	.169	83	.000	.920	83	.000
Possible_interpretation_3	.140	83	.000	.954	83	.005
Good_interpretation_3	.166	83	.000	.946	83	.002
Excellent_interpretation_3	.327	83	.000	.728	83	.000
Poor_interpretation_6	.115	83	.009	.959	83	.009
Possible_interpretation_6	.104	83	.026	.980	83	.237
Good_interpretation_6	.113	83	.010	.967	83	.033
Excellent_interpretation_6	.316	83	.000	.690	83	.000

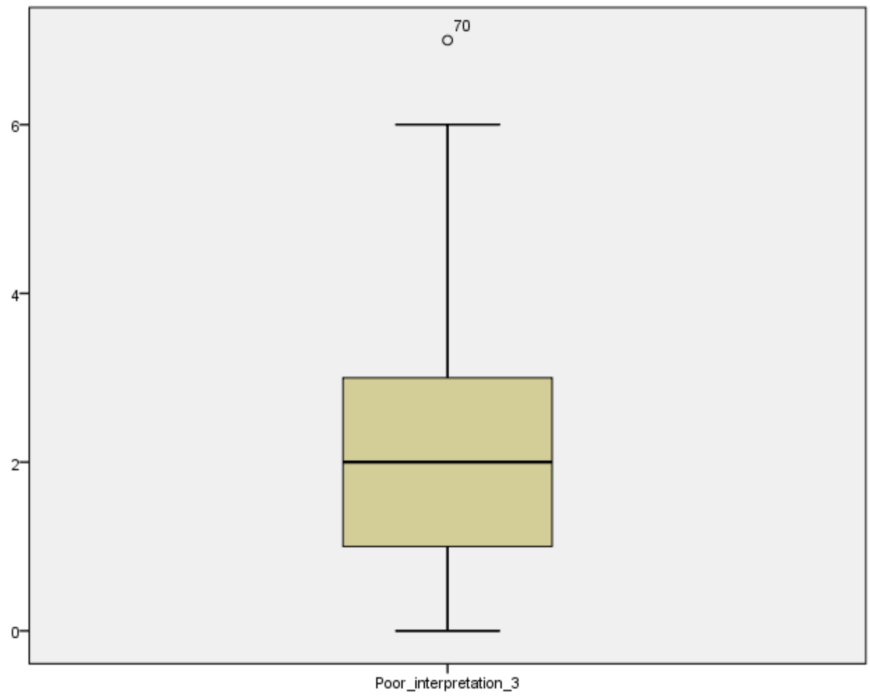
a. Lilliefors Significance Correction

Poor_interpretation_3

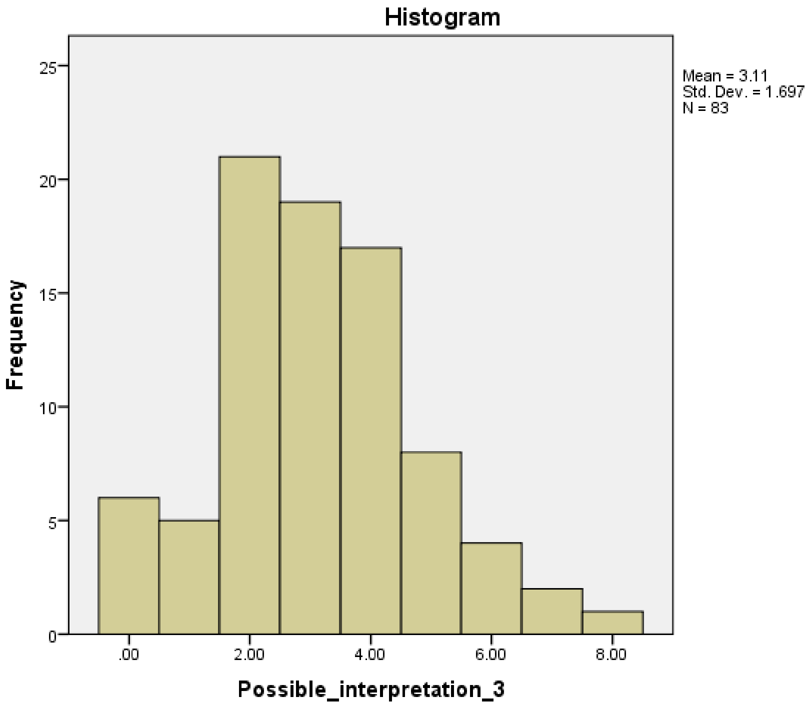


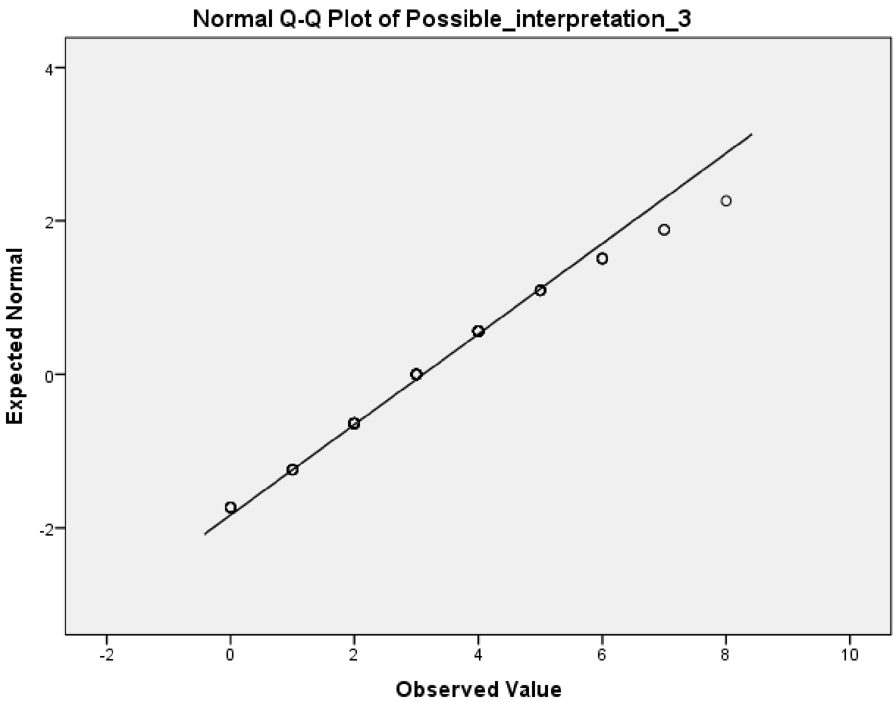


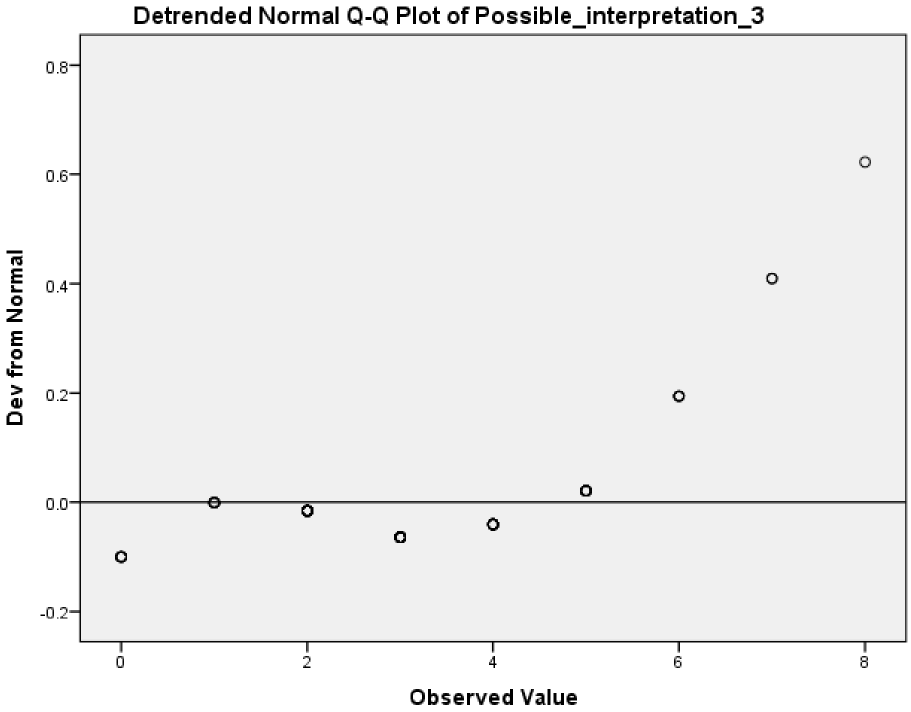

Detrended Normal Q-Q Plot of Poor_interpretation_3
Dev from Normal
Observed Value

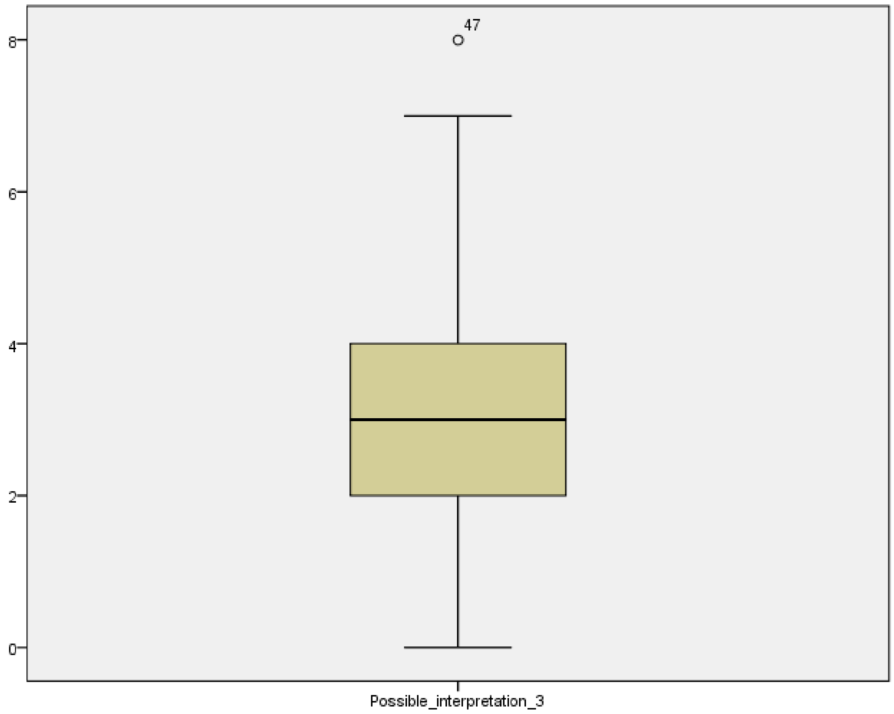

70
Poor_interpretation_3

Possible_interpretation_3

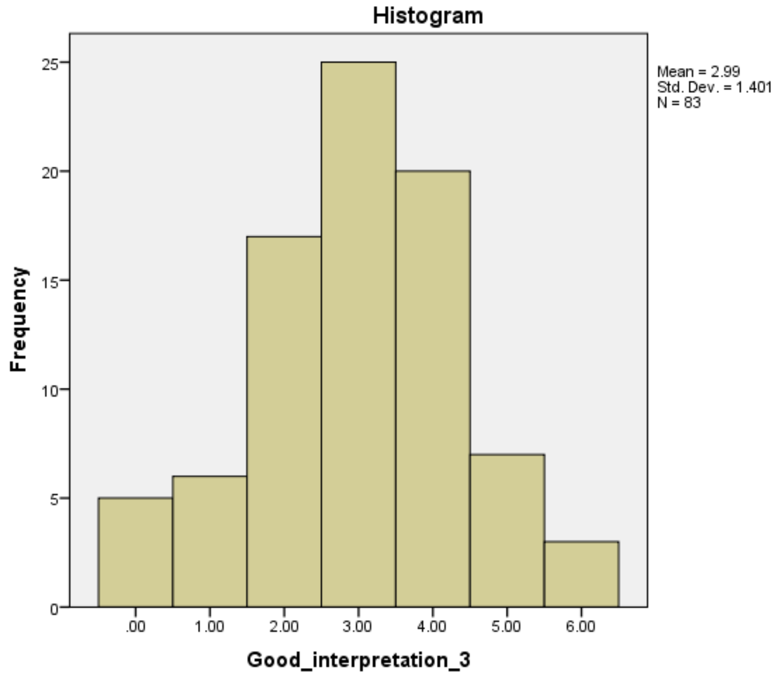


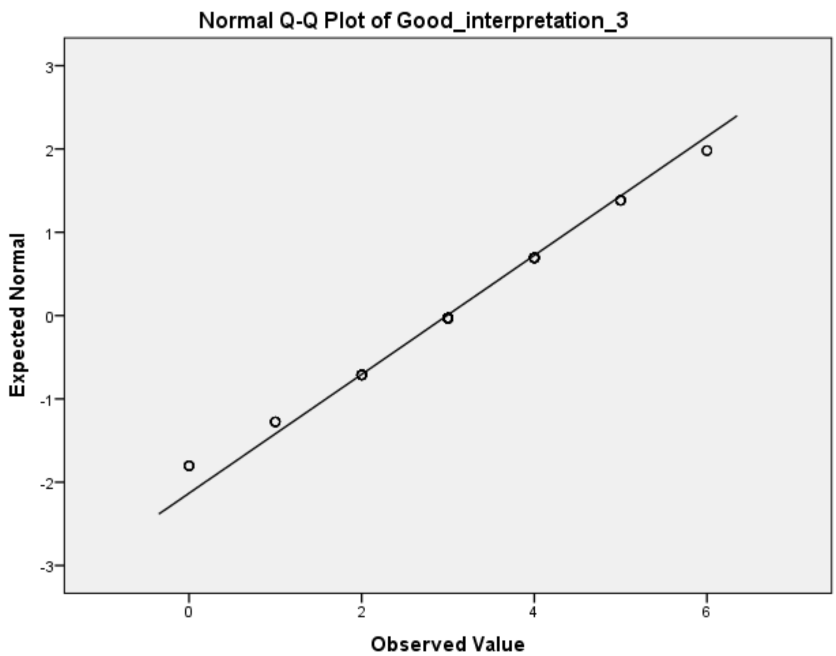


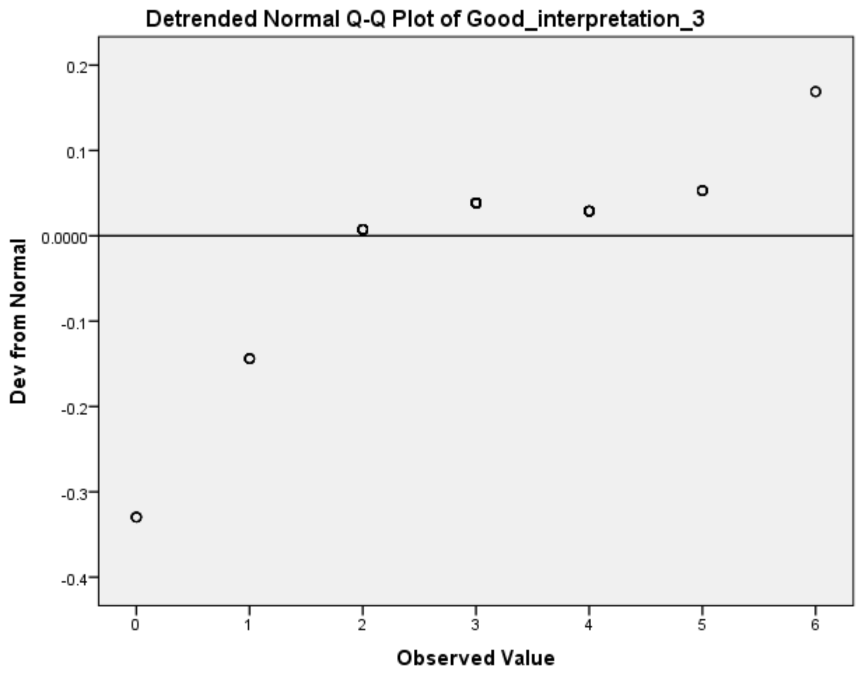

Detrended Normal Q-Q Plot of Possible_interpretation_3
Dev from Normal
0.8
0.6
0.4
0.2
0.0
-0.2
0
2
4
6
8
Observed Value

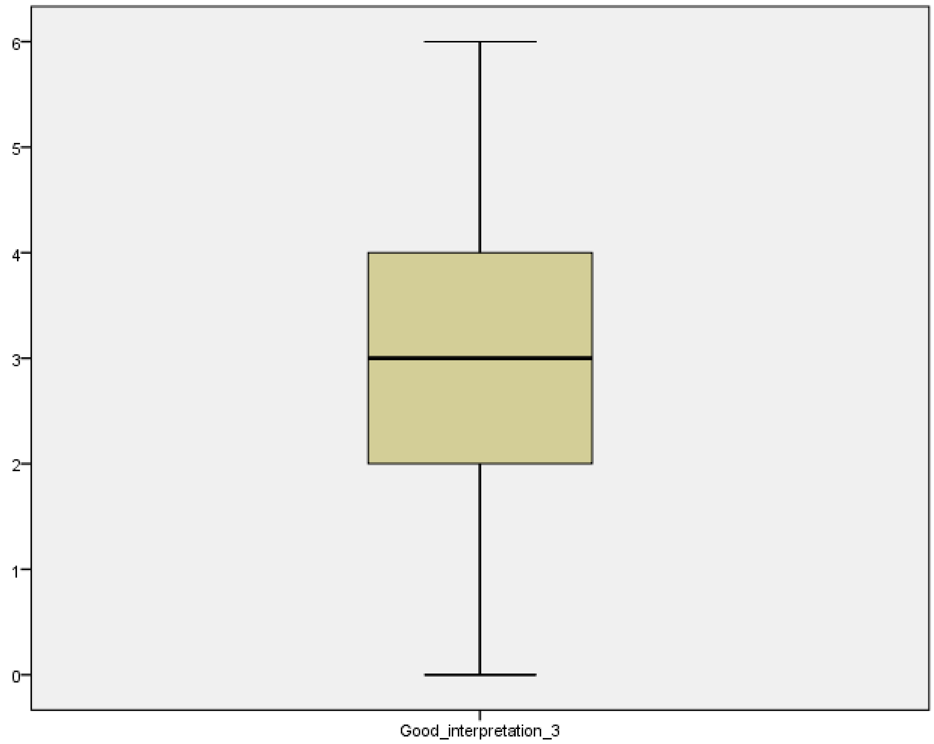

47
8
6
4
2
0
Possible_interpretation_3

Good_interpretation_3

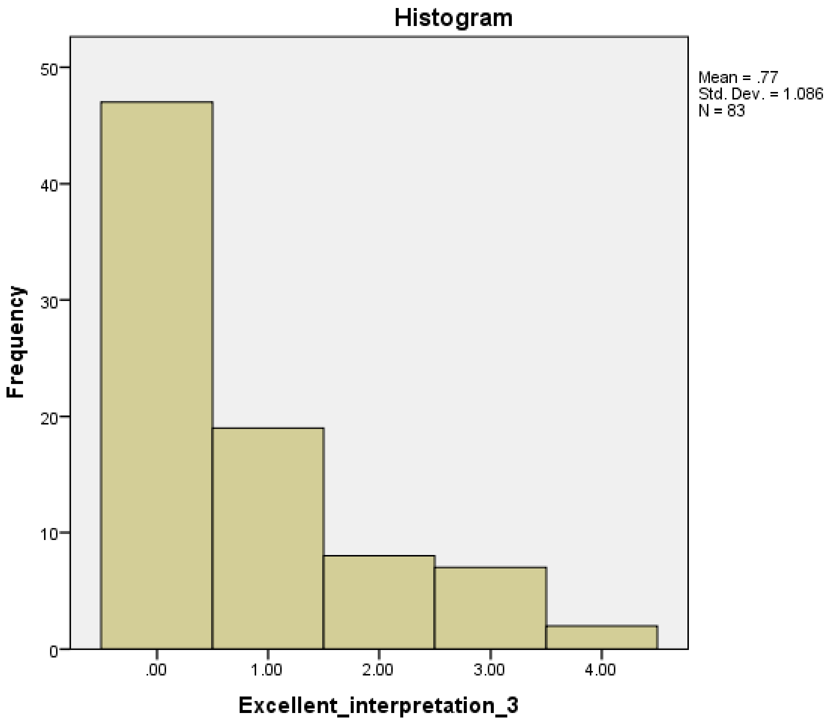


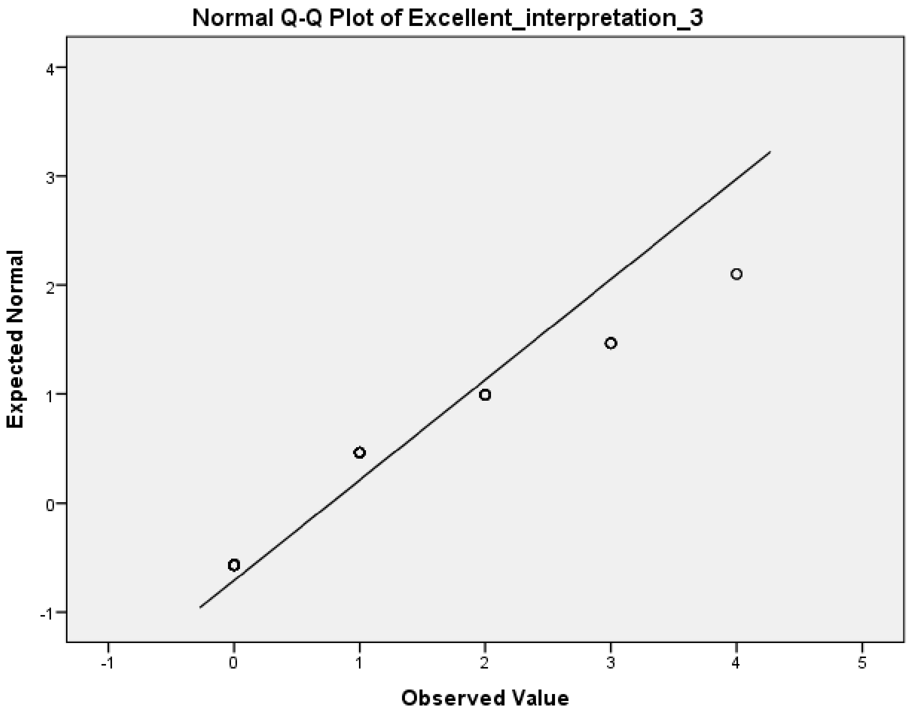


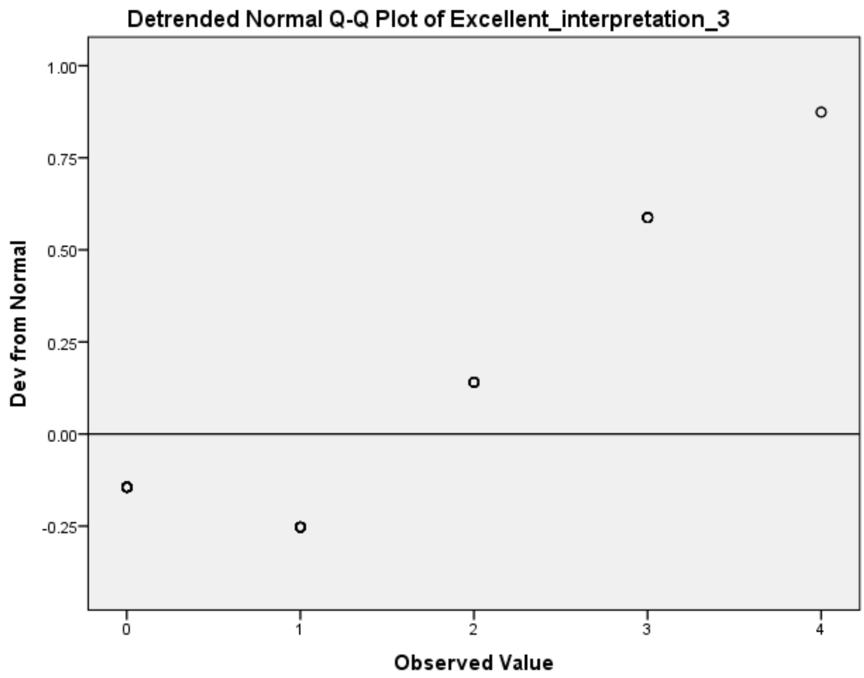

Detrended Normal Q-Q Plot of Good_interpretation_3
Dev from Normal
Observed Value
0.2
0.1
0.0000
-0.1
-0.2
-0.3
-0.4
0
1
2
3
4
5
6

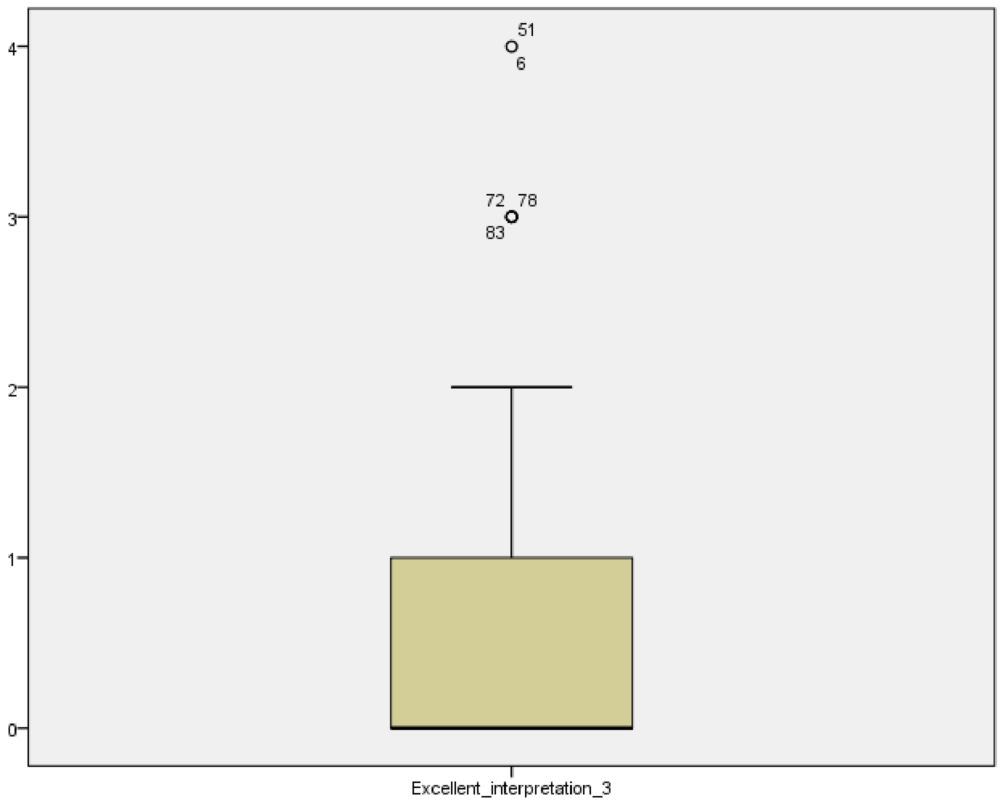

6
5
4
3
2
1
0
Good_interpretation_3

Excellent_interpretation_3

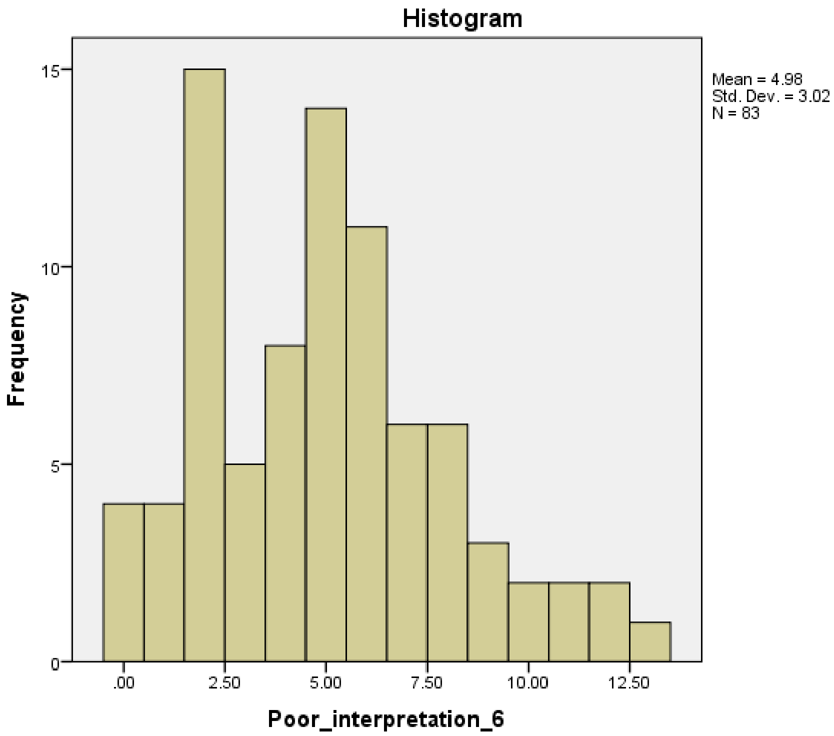


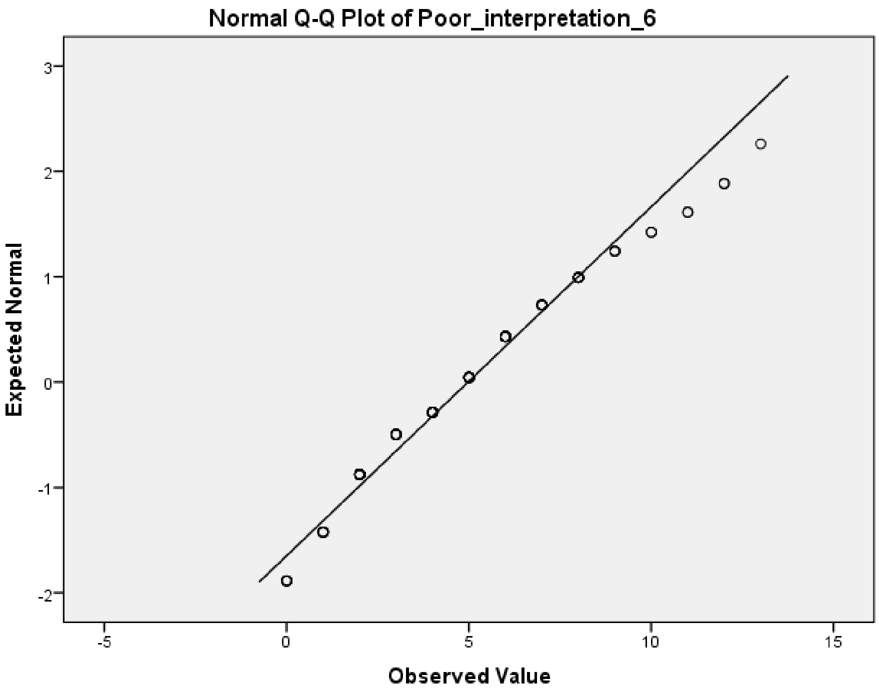


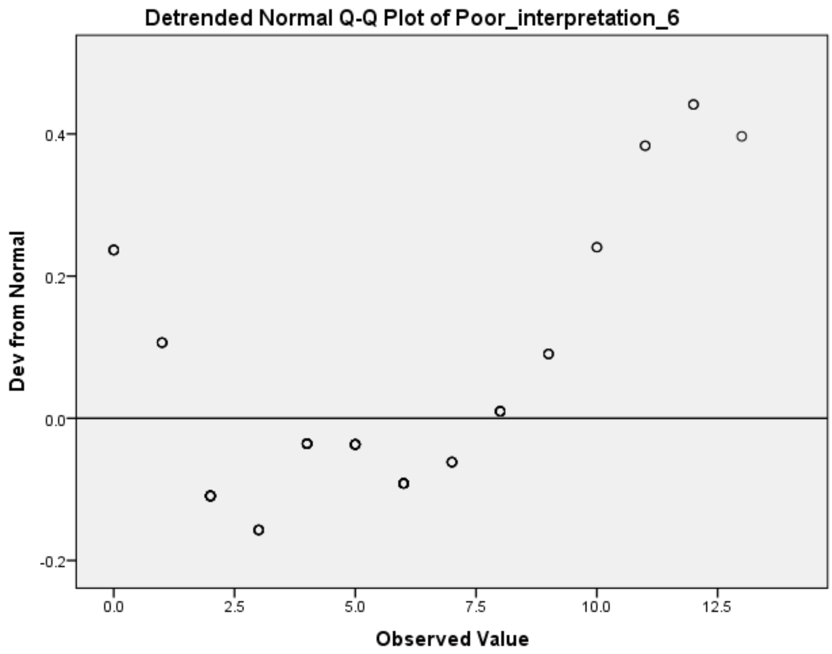

Detrended Normal Q-Q Plot of Excellent_interpretation_3
1.00
0.75
0.50
0.25
0.00
-0.25
Dev from Normal
0
1
2
3
4
Observed Value


4
3
2
1
0
51
6
72
78
83
Excellent_interpretation_3

Poor_interpretation_6

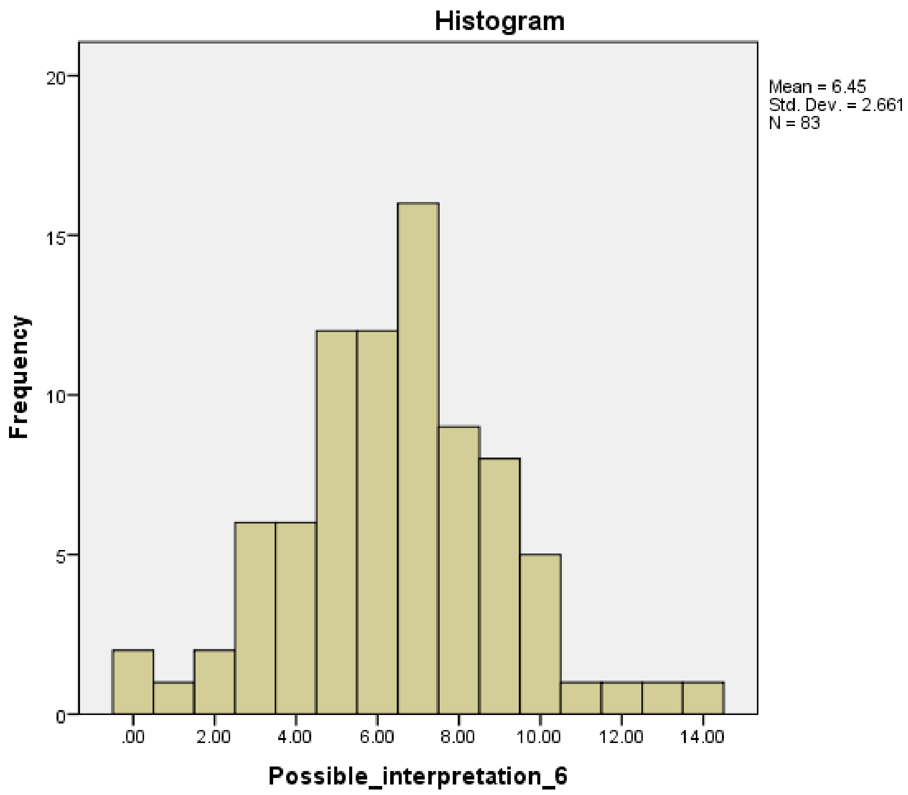


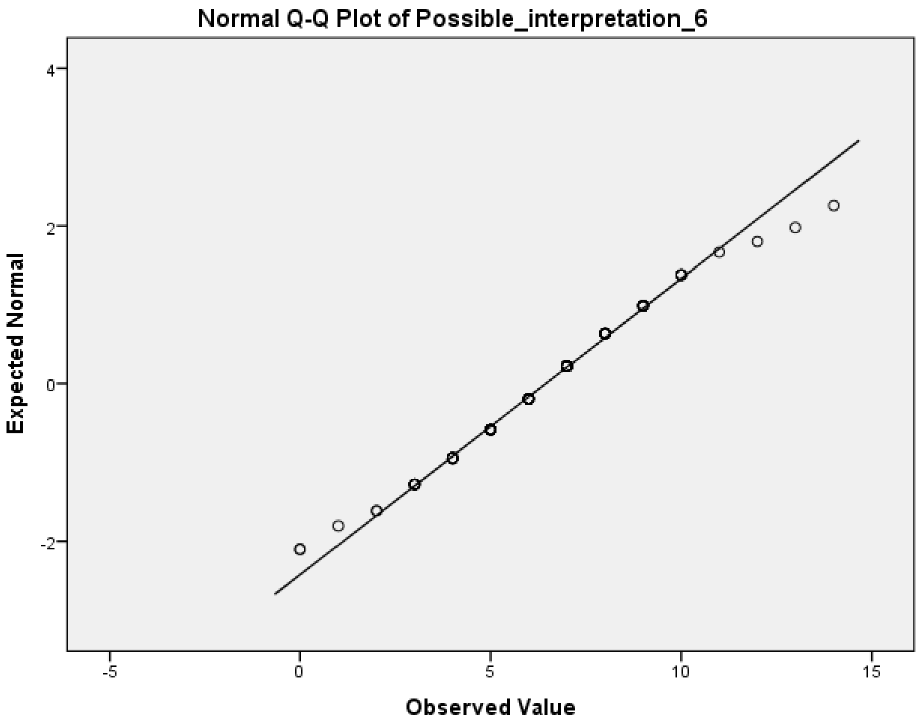


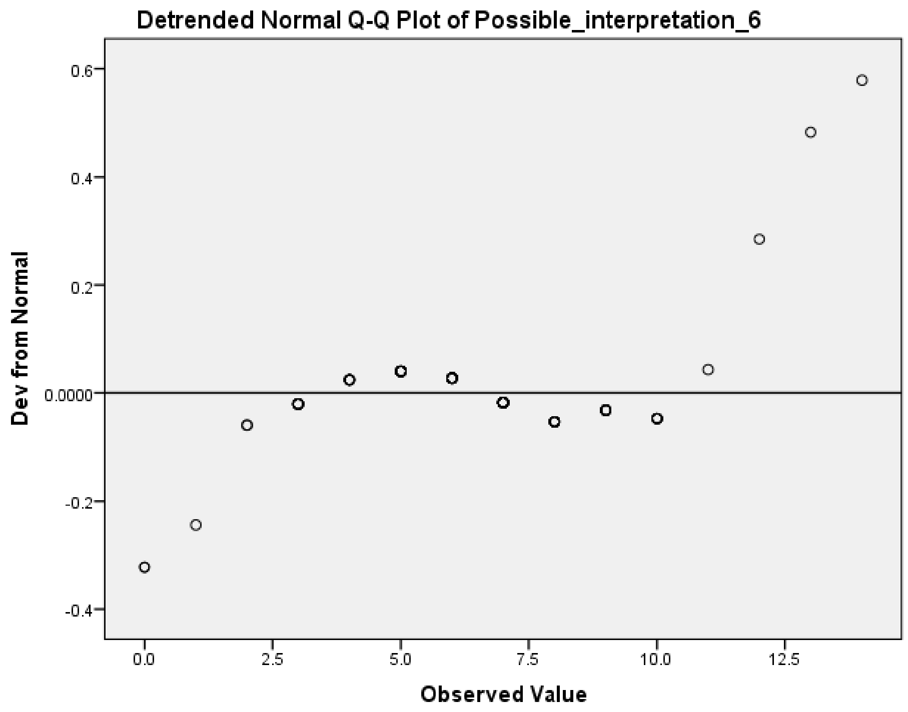

Detrended Normal Q-Q Plot of Poor_interpretation_6
Dev from Normal
0.4
0.2
0.0
-0.2
0.0
2.5
5.0
7.5
10.0
12.5
Observed Value

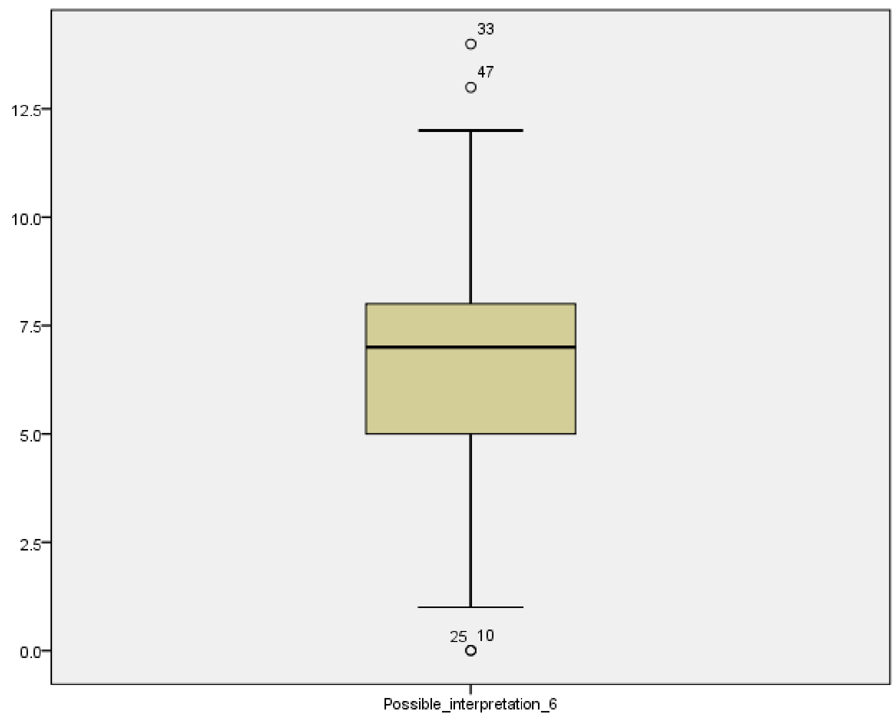

12.5
10.0
7.5
5.0
2.5
0.0
Poor_interpretation_6

Possible_interpretation_6

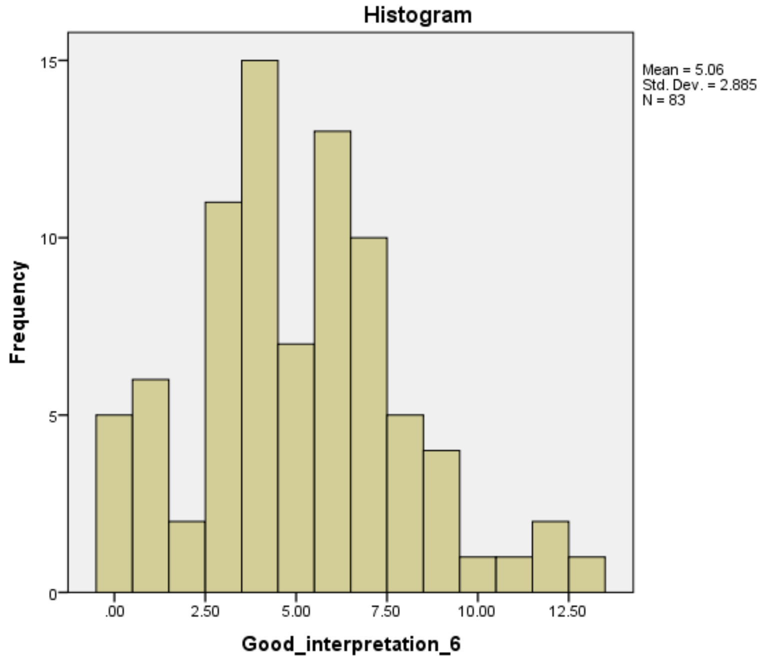


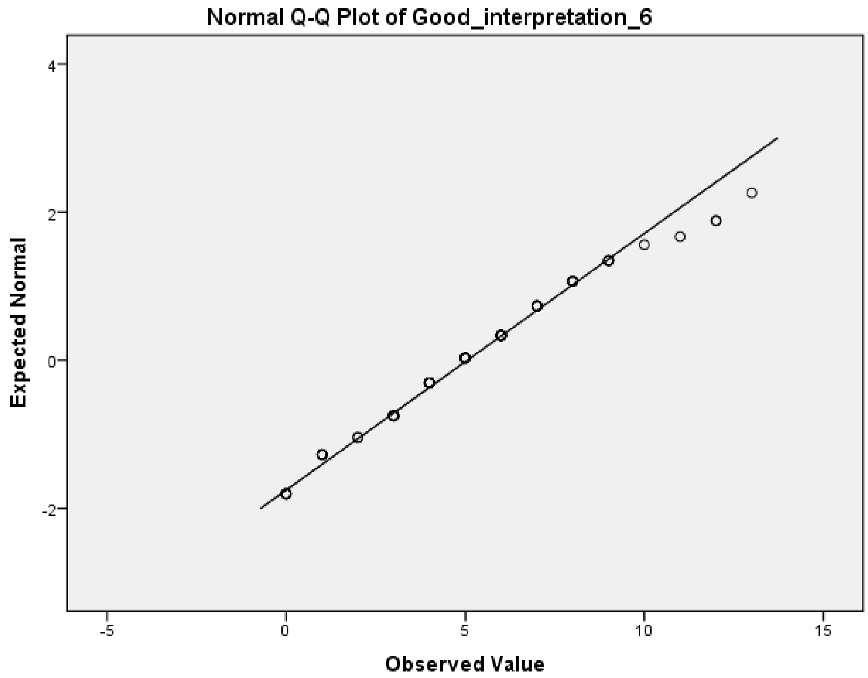


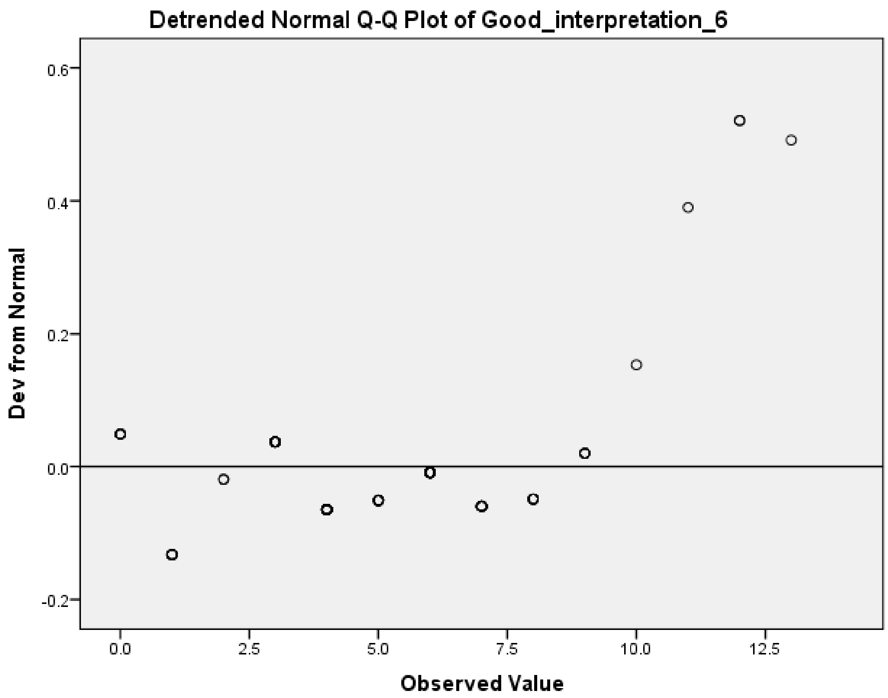

Detrended Normal Q-Q Plot of Possible_interpretation_6
Dev from Normal
0.6
0.4
0.2
0.0000
-0.2
-0.4
0.0
2.5
5.0
7.5
10.0
12.5
Observed Value

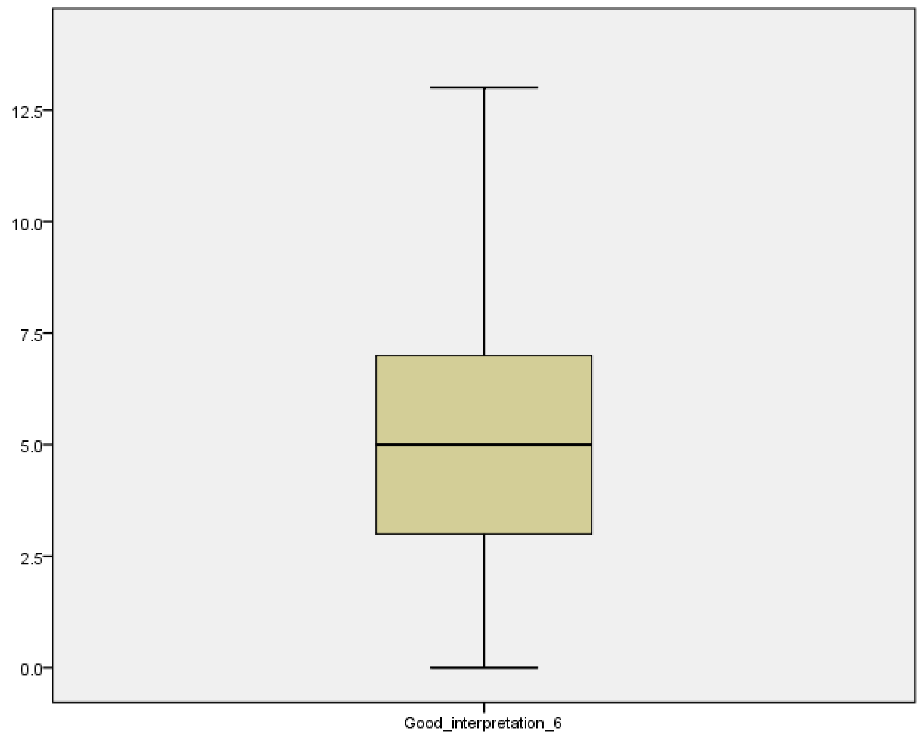

33
47
25
10
12.5
10.0
7.5
5.0
2.5
0.0
Possible_interpretation_6

Good_interpretation_6

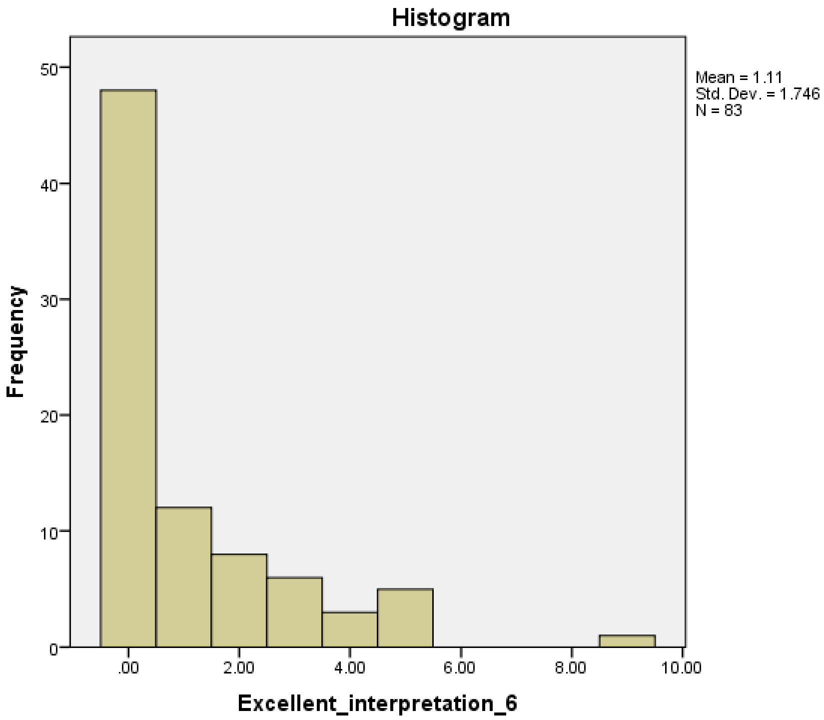


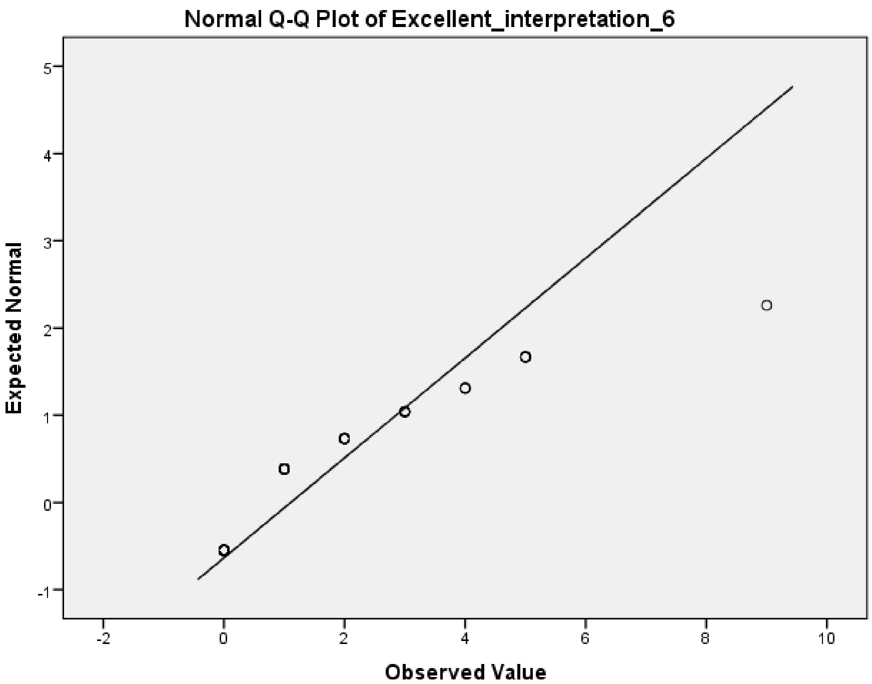


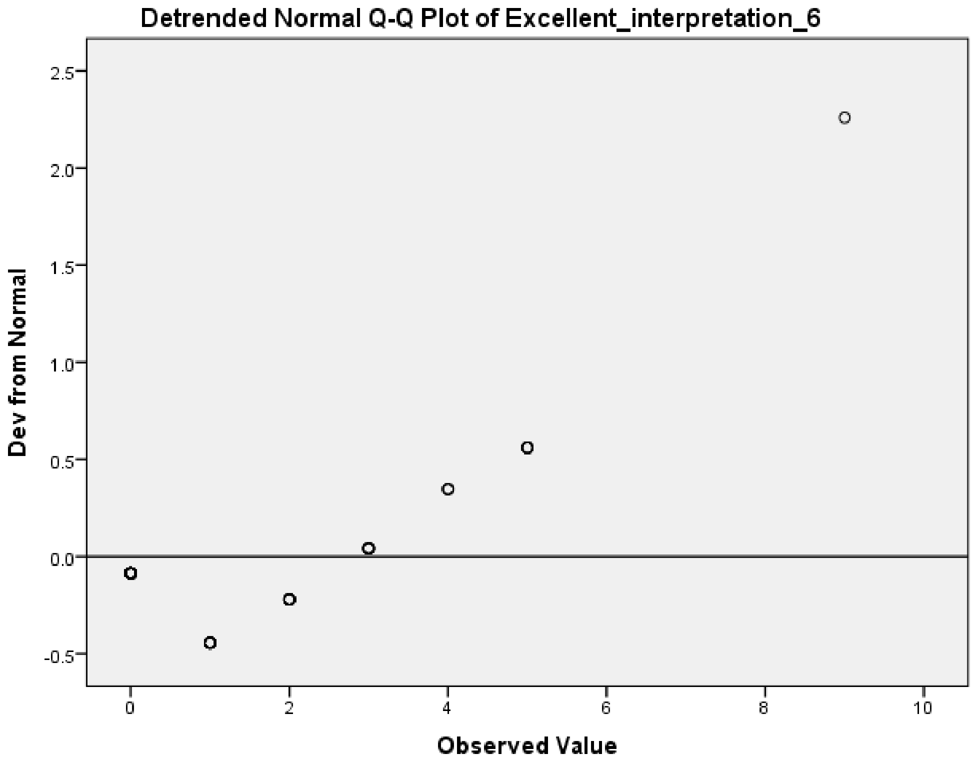

Detrended Normal Q-Q Plot of Good_interpretation_6
Dev from Normal
0.6
0.4
0.2
0.0
-0.2
0.0
2.5
5.0
7.5
10.0
12.5
Observed Value


12.5
10.0
7.5
5.0
2.5
0.0
Good_interpretation_6

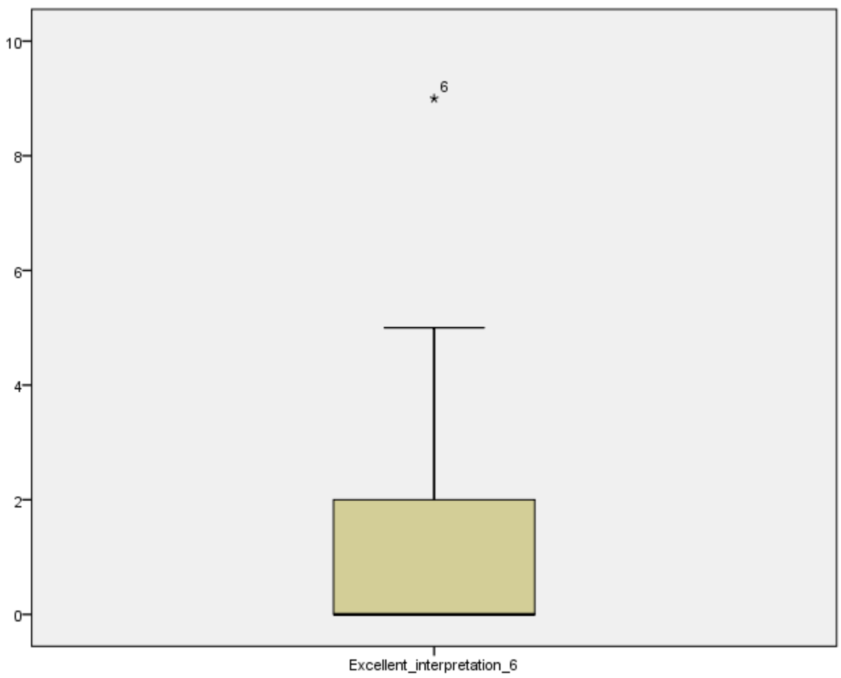
Excellent_interpretation_6







Detrended Normal Q-Q Plot of Excellent_interpretation_6
Dev from Normal
Observed Value



Excellent_interpretation_6

Snowy Pictures Task

Explore

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Snowy_Pictures_correct_answer	83	100.0%	0	0.0%	83	100.0%
Snowy_Pictures_false_positives	83	100.0%	0	0.0%	83	100.0%
Snowy_Pictures_incorrect_attempt	83	100.0%	0	0.0%	83	100.0%
Snowy_Pictures_none_correct	83	100.0%	0	0.0%	83	100.0%

Descriptives

			Statistic	Std. Error
Snowy_Pictures_correct_answer	Mean		5.5904	.26056
	95% Confidence Interval for Mean	Lower Bound	5.0720	
		Upper Bound	6.1087	
	5% Trimmed Mean		5.6693	
	Median		6.0000	
	Variance		5.635	
	Std. Deviation		2.37382	
	Minimum		.00	
	Maximum		10.00	
	Range		10.00	
	Interquartile Range		3.00	
	Skewness		-.505	.264
	Kurtosis		-.272	.523
Snowy_Pictures_false_positives	Mean		3.2771	.30149
	95% Confidence Interval for Mean	Lower Bound	2.6774	
		Upper Bound	3.8769	
	5% Trimmed Mean		3.0897	
	Median		3.0000	
	Variance		7.544	
	Std. Deviation		2.74668	
	Minimum		.00	
	Maximum		12.00	
	Range		12.00	
	Interquartile Range		4.00	
	Skewness		.861	.264

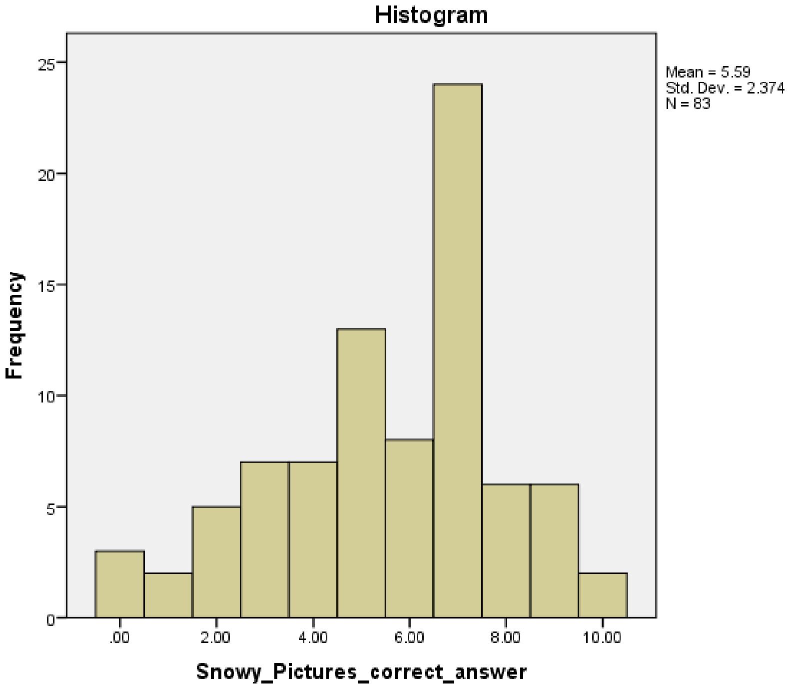
	Kurtosis		.391	.523
Snowy_Pictures_incorrect_attempt	Mean		6.2169	.26559
	95% Confidence Interval for Mean	Lower Bound	5.6885	
		Upper Bound	6.7452	
	5% Trimmed Mean		6.1854	
	Median		6.0000	
	Variance		5.855	
	Std. Deviation		2.41968	
	Minimum		1.00	
	Maximum		12.00	
	Range		11.00	
	Interquartile Range		3.00	
	Skewness		.279	.264
	Kurtosis		-.164	.523
Snowy_Pictures_none_correct	Mean		8.5422	.31900
	95% Confidence Interval for Mean	Lower Bound	7.9076	
		Upper Bound	9.1768	
	5% Trimmed Mean		8.7631	
	Median		9.0000	
	Variance		8.446	
	Std. Deviation		2.90626	
	Minimum		.00	
	Maximum		12.00	
	Range		12.00	
	Interquartile Range		4.00	
	Skewness		-.915	.264
	Kurtosis		.496	.523

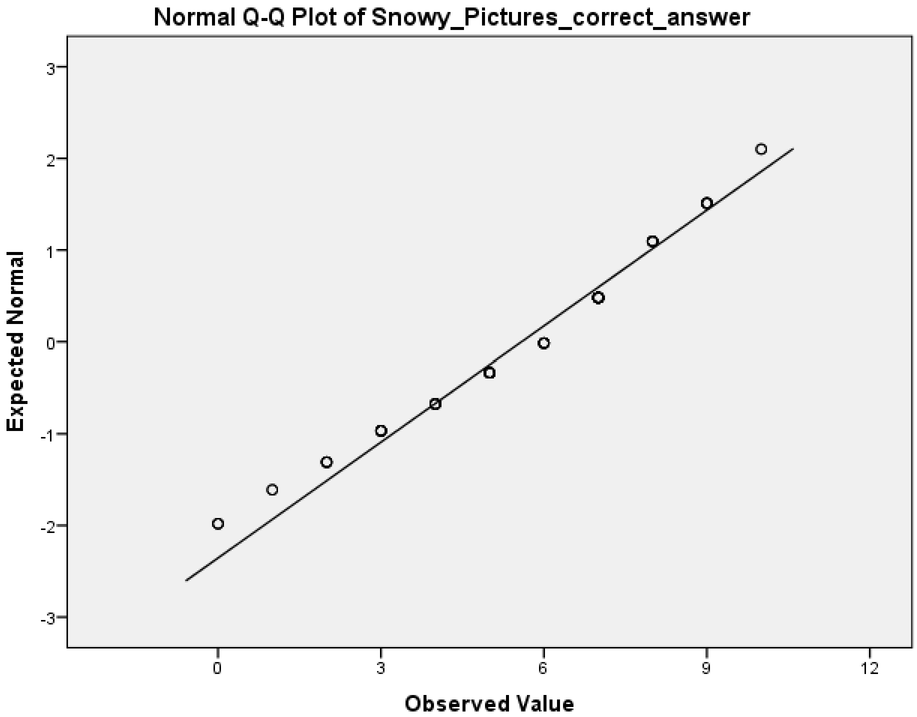
Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Snowy_Pictures_correct_answer	.182	83	.000	.949	83	.002
Snowy_Pictures_false_positives	.149	83	.000	.915	83	.000
Snowy_Pictures_incorrect_attempt	.162	83	.000	.967	83	.033
Snowy_Pictures_none_correct	.150	83	.000	.909	83	.000

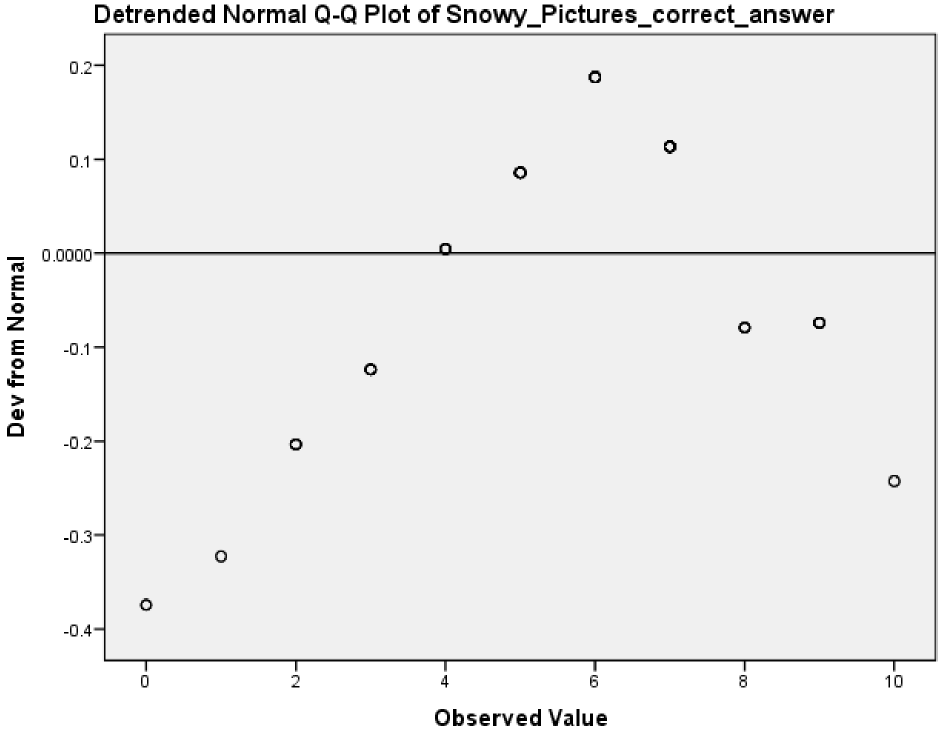
a. Lilliefors Significance Correction

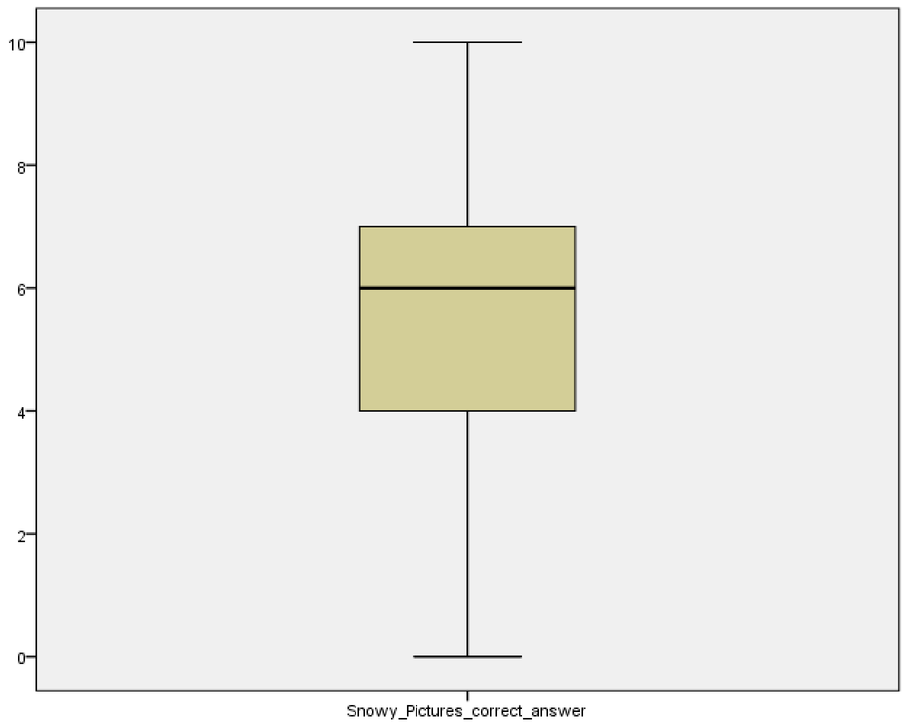
Snowy_Pictures_correct_answer



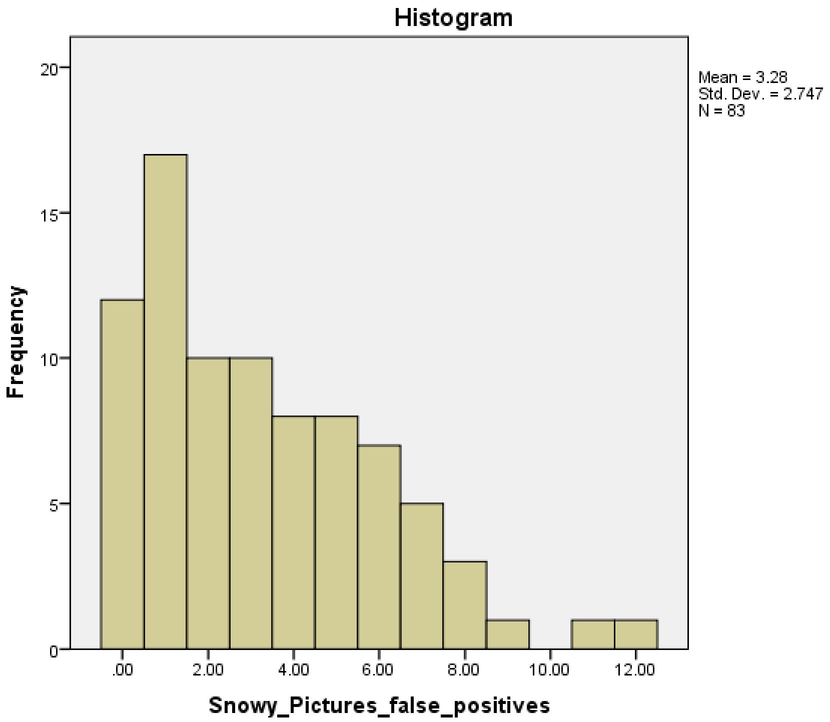


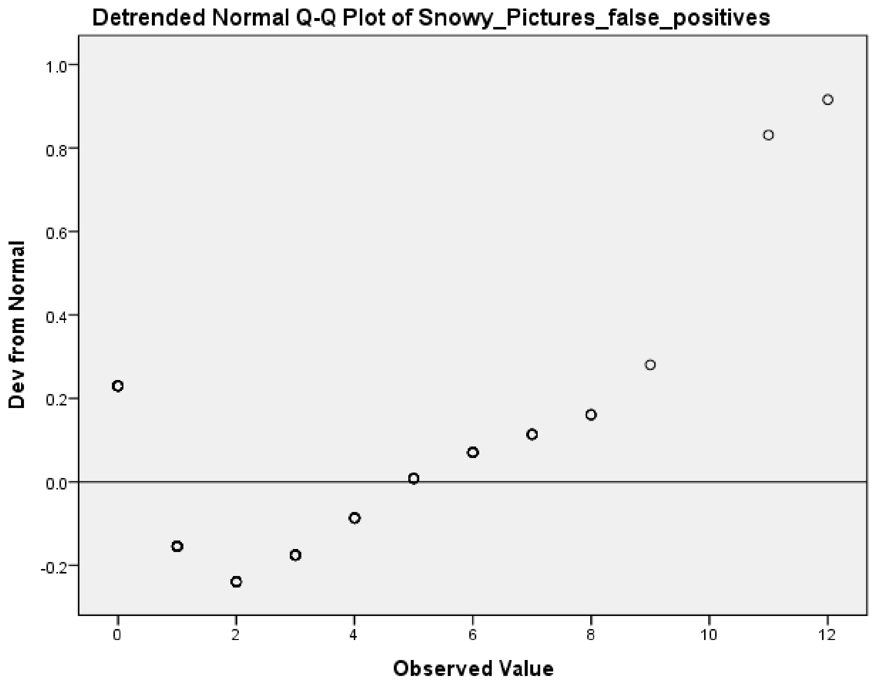
Detrended Normal Q-Q Plot of Snowy_Pictures_correct_answer



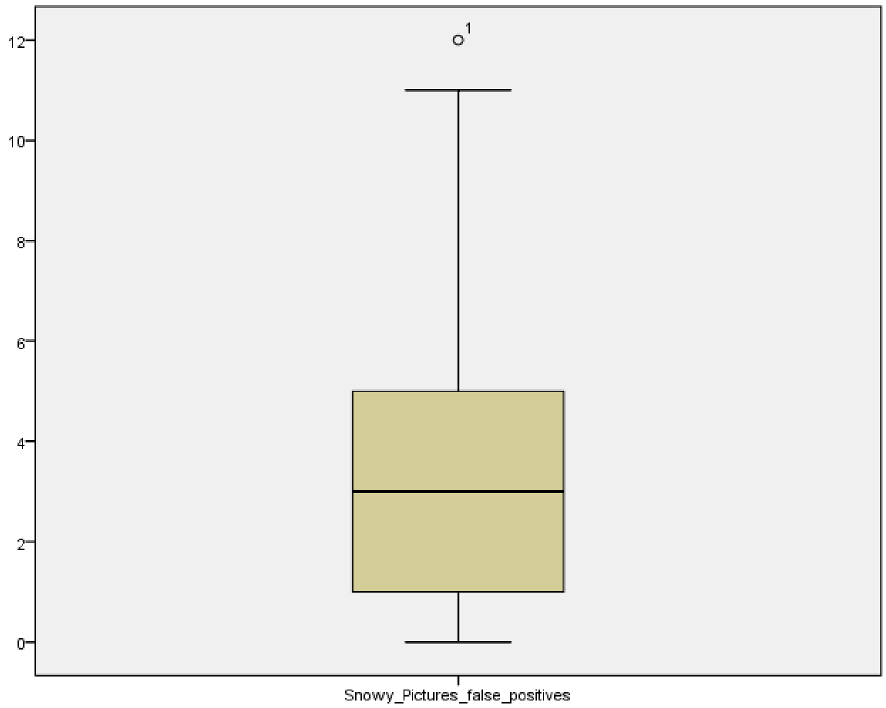


Snowy_Pictures_false_positives



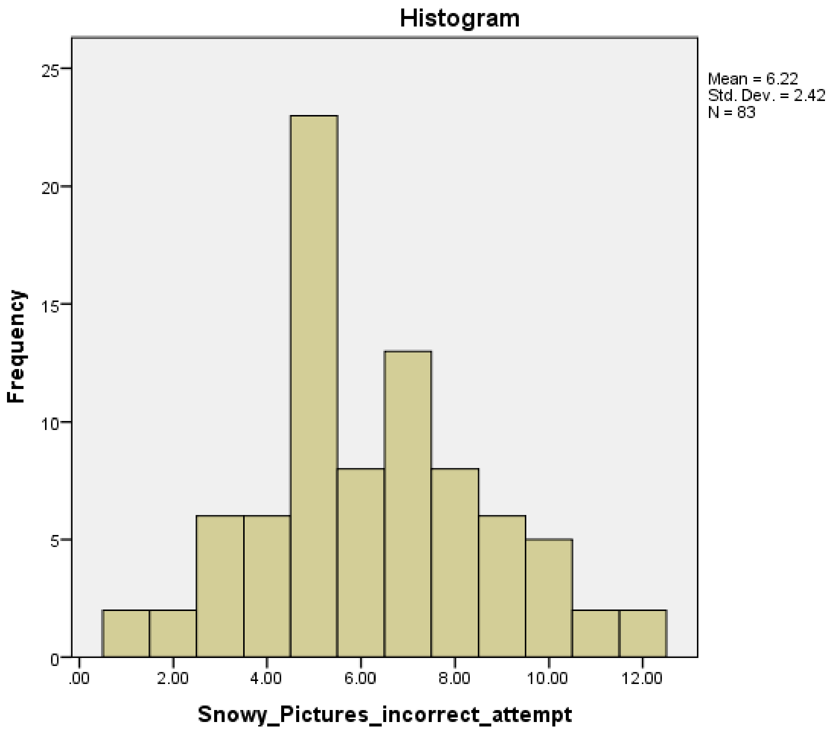


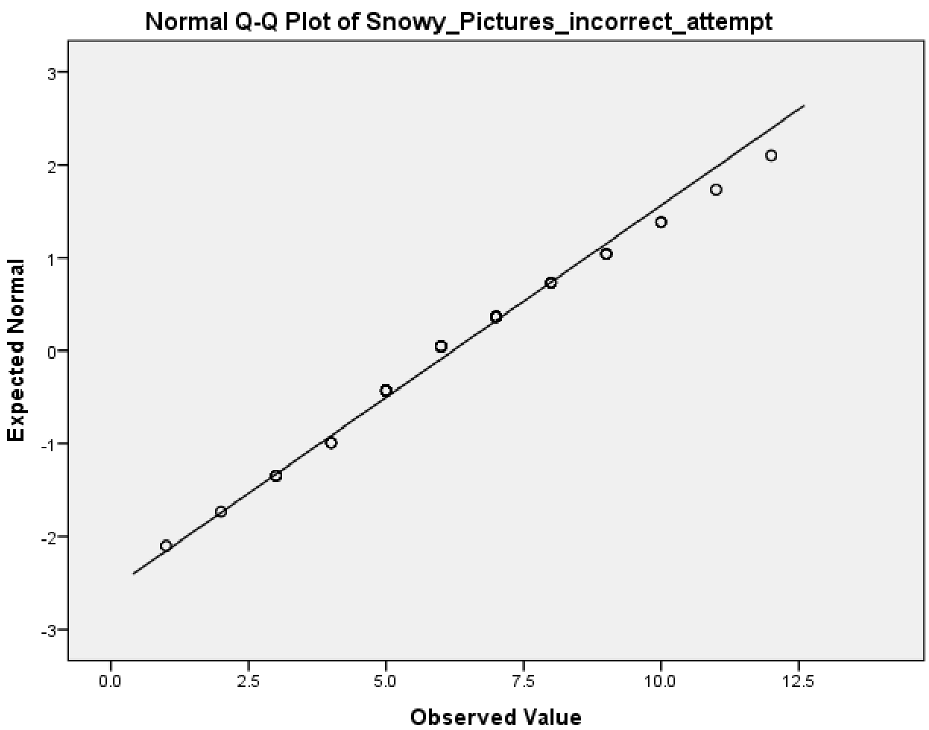
Detrended Normal Q-Q Plot of Snowy_Pictures_false_positives
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
Dev from Normal
0
2
4
6
8
10
12
Observed Value

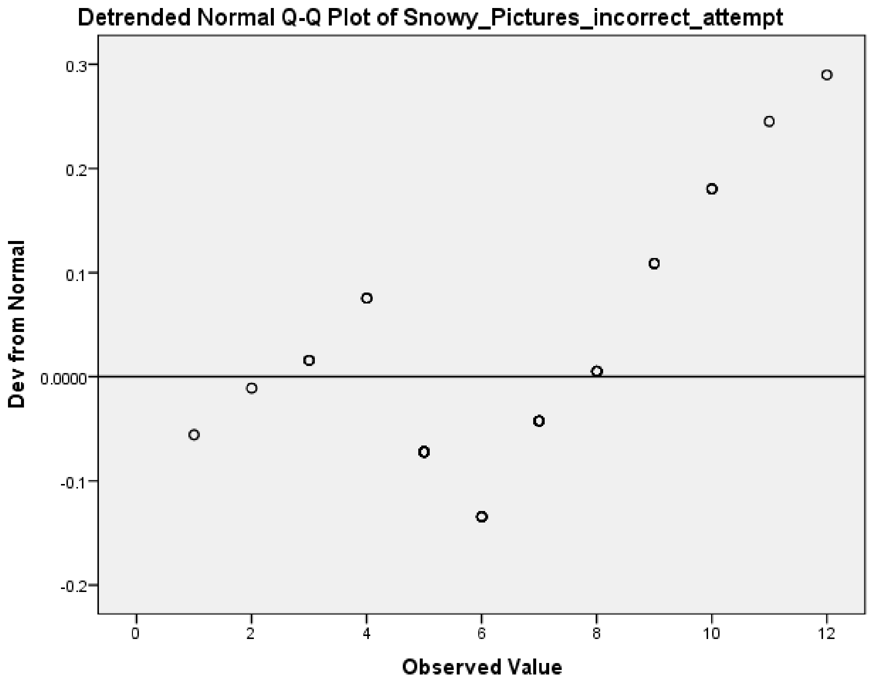


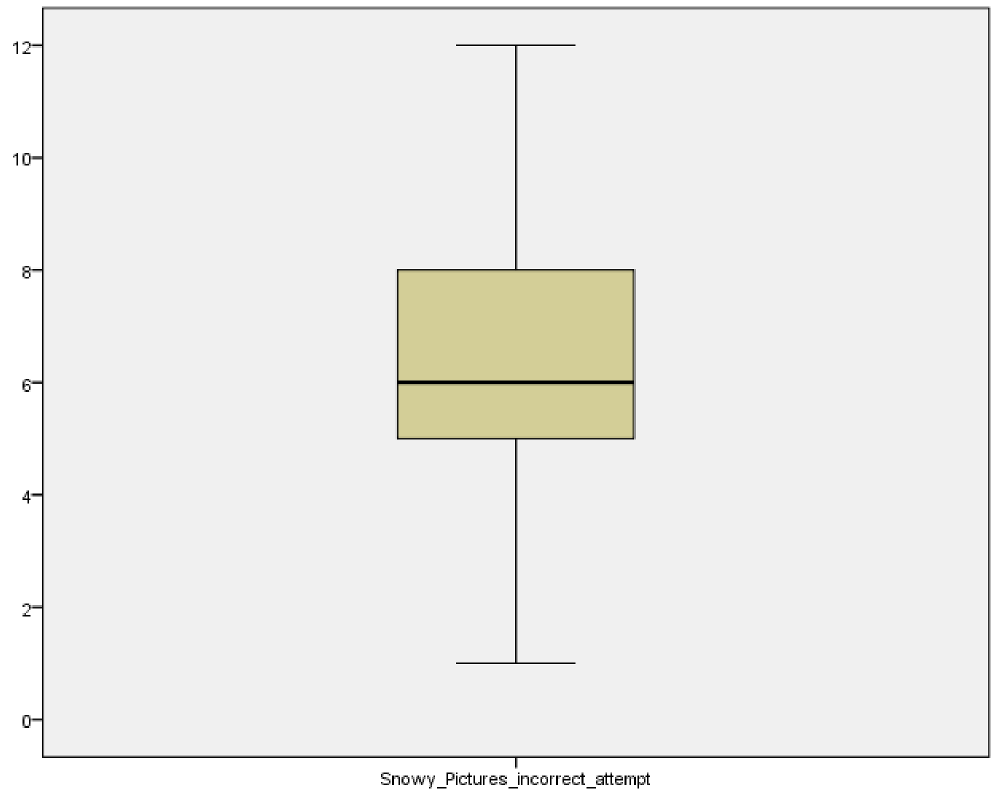
12
10
8
6
4
2
0
1
Snowy_Pictures_false_positives

Snowy_Pictures_incorrect_attempt

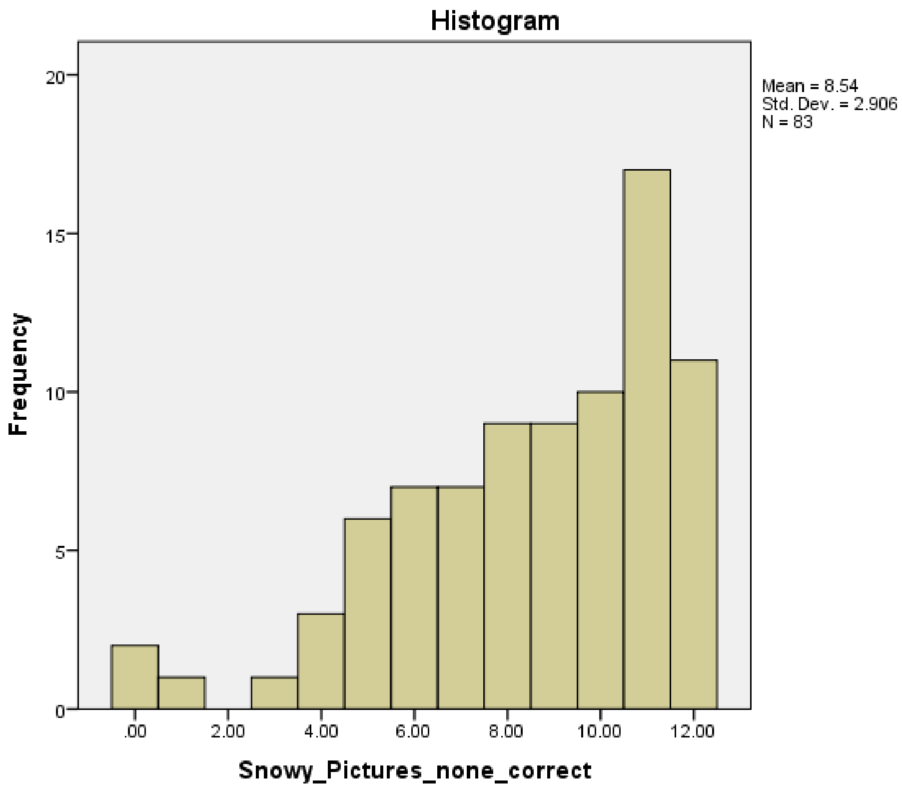


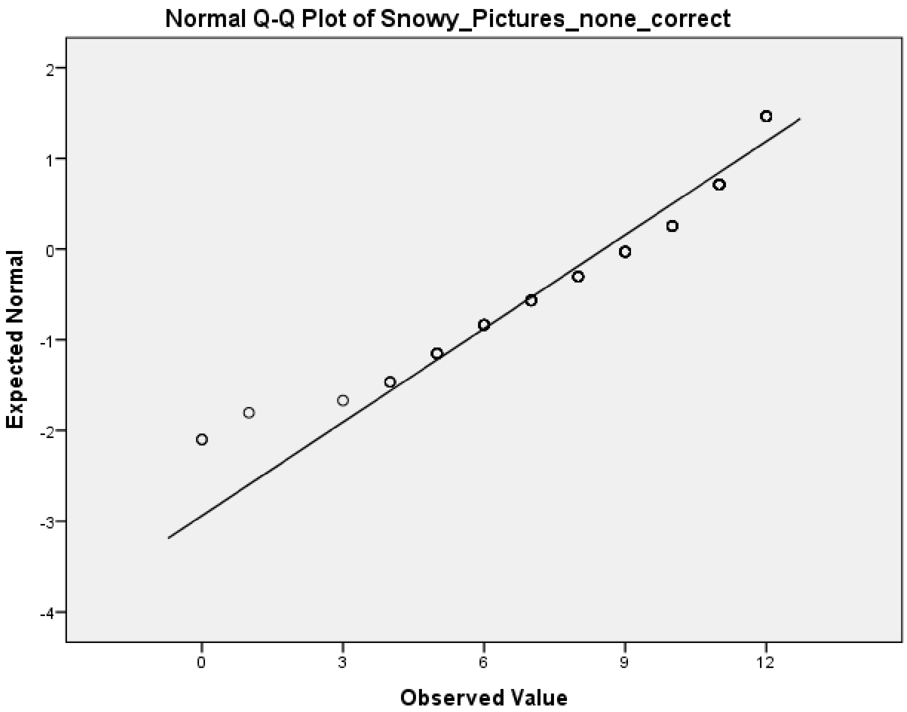


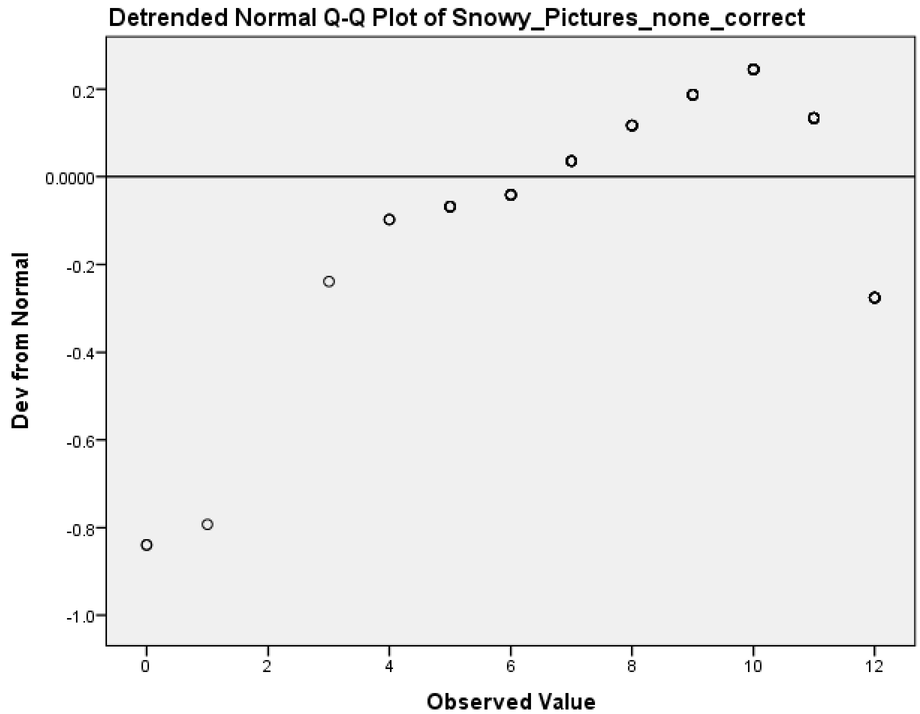

Detrended Normal Q-Q Plot of Snowy_Pictures_incorrect_attempt
Dev from Normal
Observed Value
0.3
0.2
0.1
0.0000
-0.1
-0.2
0
2
4
6
8
10
12

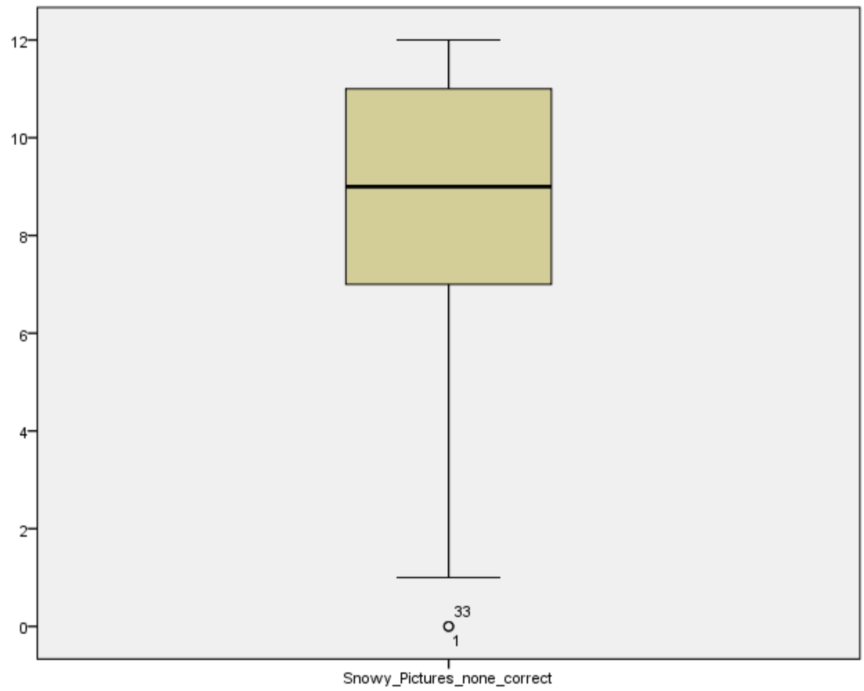

12
10
8
6
4
2
0
Snowy_Pictures_incorrect_attempt

Snowy_Pictures_none_correct






Detrended Normal Q-Q Plot of Snowy_Pictures_none_correct
Dev from Normal
Observed Value
0.2
0.0000
-0.2
-0.4
-0.6
-0.8
-1.0
0
2
4
6
8
10
12


12
10
8
6
4
2
0
33
1
Snowy_Pictures_none_correct

Coincidences

Explore

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Total_coincidences	83	100.0%	0	0.0%	83	100.0%

Descriptives

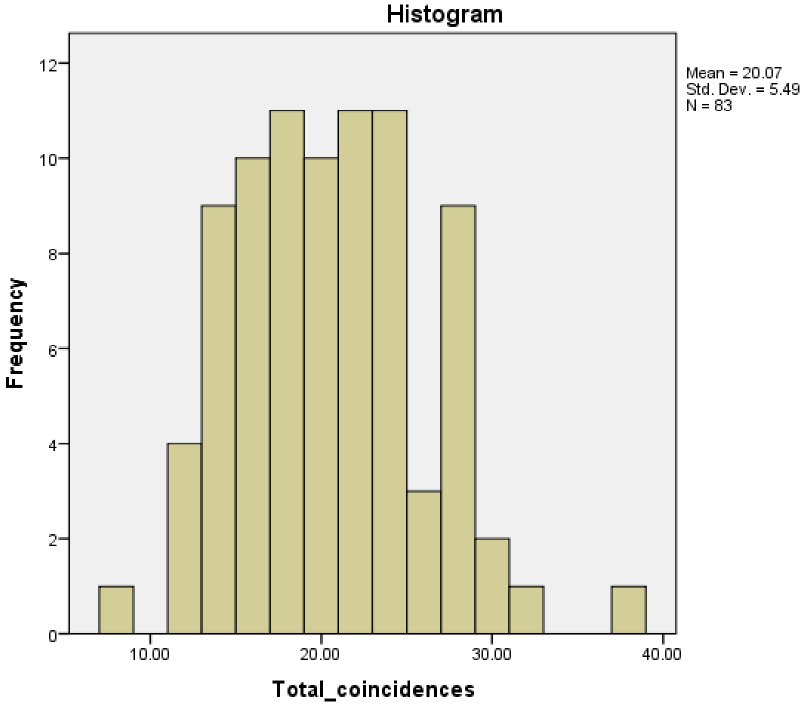
			Statistic	Std. Error
Total_coincidences	Mean		20.0723	.60262
	95% Confidence Interval for Mean	Lower Bound	18.8735	
		Upper Bound	21.2711	
	5% Trimmed Mean		19.9331	
	Median		20.0000	
	Variance		30.141	
	Std. Deviation		5.49009	
	Minimum		8.00	
	Maximum		38.00	
	Range		30.00	
	Interquartile Range		8.00	
	Skewness		.414	.264
	Kurtosis		.244	.523

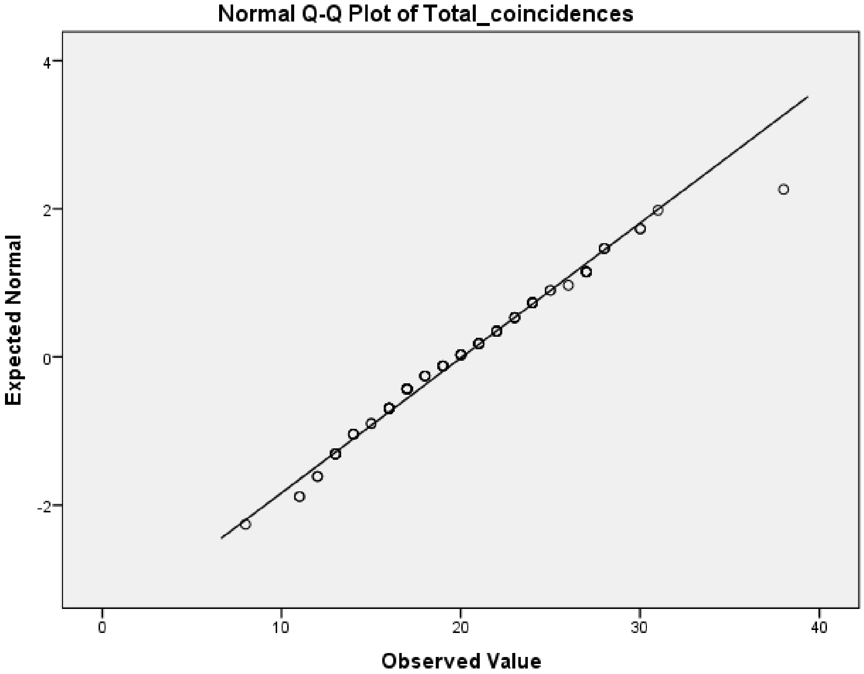
Tests of Normality

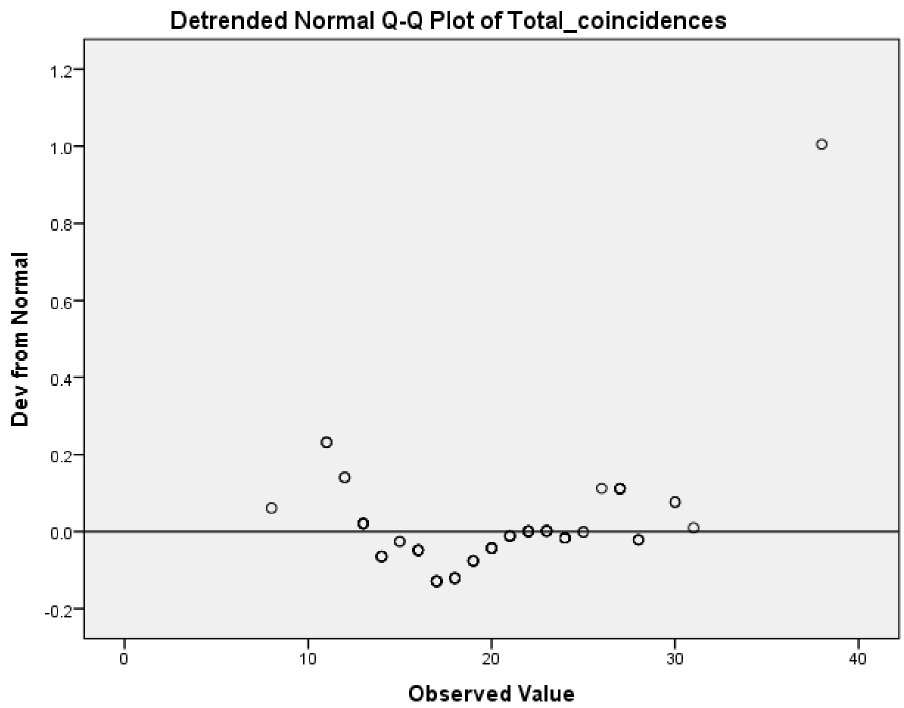
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Total_coincidences	.086	83	.200	.981	83	.265

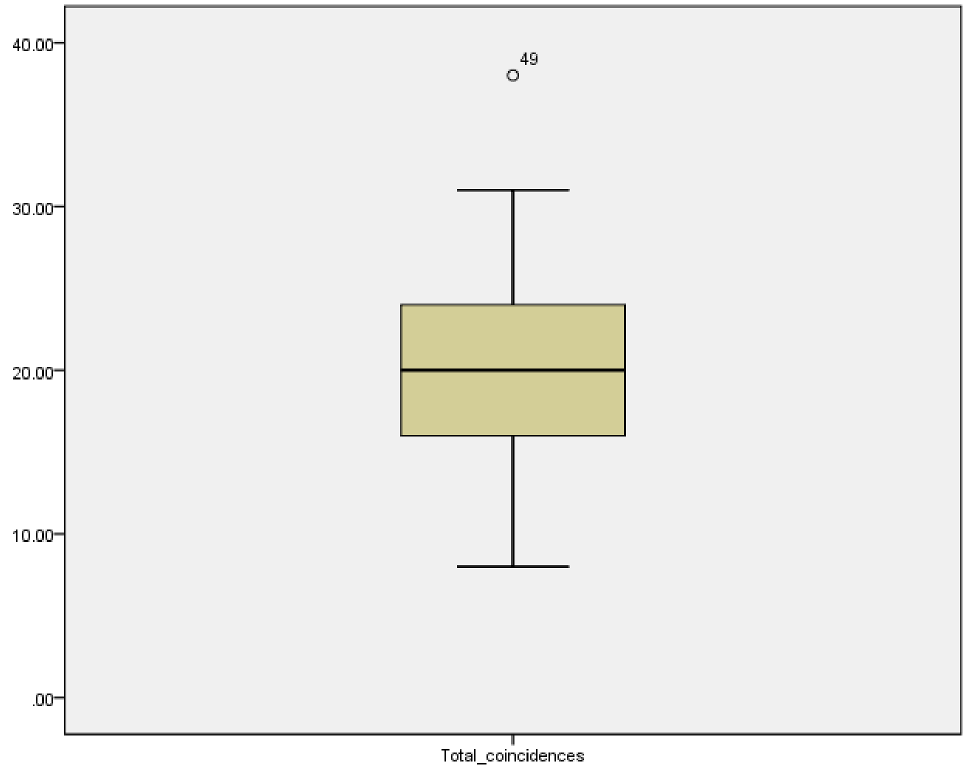
a. Lilliefors Significance Correction

Total_coincidences






Detrended Normal Q-Q Plot of Total_coincidences
Dev from Normal
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
0
10
20
30
40
Observed Value


40.00
30.00
20.00
10.00
.00
49
Total_coincidences